OVERSIGHT ON FAA's FISCAL YEAR 1991 R&D PROGRAM

HEARINGS

BEFORE THE

SUBCOMMITTEE ON TRANSPORTATION,
AVIATION AND MATERIALS

OF THE

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SCIENCE, SPACE, AND TECHNOLOGY
U.S. HOUSE OF REPRESENTATIVES

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OVERSIGHT ON FAA's FISCAL YEAR 1991 R&D PROGRAM

TUESDAY, APRIL 24, 1990

U.S. House of Representatives,
Committee on Science, Space, and Technology,
Subcommittee on Transportation, Aviation and Materials,
Washington, D.C.

The subcommittee met, pursuant to notice, at 3:33 p.m. in room 2325, Rayburn House Office Building, Hon. Robert G. Torricelli [chairman of the subcommittee] presiding.

Mr. **Torricelli**. The subcommittee will come to order.

Good day and welcome. Today the subcommittee will receive testimony with regard to the 1991 budget authorization process. I welcome the committee members and appreciate their attendance here this afternoon.

As the House authorizing committee, it is our responsibility to ensure that the FAA has the funding authorization level it needs to do the research that will provide the public with the safest and most efficient aviation system possible—for today, tomorrow, and into the future.

It is my intuitive sense that the $190 million requested by the Administration is probably inadequate for doing that job. The hearings this week will help this subcommittee determine the appropriation authorization level.

The FAA and the aviation industry are often criticized for having no sense of vision beyond the next evolutionary step of existing or well understood technologies. The claim is that the FAA lacks the imagination and boldness to seriously challenge the current way of doing business in a way that merits attention.

I hope that is not the case because without imagination and boldness there is no enthusiasm; and without Congressional enthusiasm, there is no support.

I want to hear about the problems facing aviation, and then I want to hear about the exciting research that will fix those problems. For example, I hope we do not hear that air traffic controllers will be forced to increasingly constrain air traffic in order to cope with the growing number of aircraft in the system and then hear that the answer is a new radar system that will improve surveillance accuracy by 500 feet or a new piece of aircraft avionics that has no bearing on the air traffic control problem.

I want to hear about solutions, not about hobby shopping or what a great job the FAA is doing, wading in the technological shallow water.

I am not suggesting that research into communication, navigation, and surveillance systems are not important, because it is and that work should continue.

It is just that I would like to feel confident that the FAA and the aviation industry are also willing to explore novel and difficult research concepts that will ensure that we can accommodate the aviation demands of the future. I have no doubt that if the FAA fails to push the state of the art, the Europeans and Japanese and others will be more than willing to sell us their products.

The hearing today will receive testimony from representatives of the users of the aviation system, the commercial, business and private aircraft operators who pay the bills. They will comment on their perception to the FAA's research program and funding proposals.

We will also hear testimony regarding a subject that is near and dear to the heart of all members of Congress whose constituents live near an airport—aircraft and airport noise.

On Thursday, we will reconvene at 9:30 a.m. in room 2253, Rayburn at which time we will hear testimony from the FAA, the FAA R&D Advisory Committee, and the Air Traffic Control Association.

I'm looking forward to today's discussions and, with that, I would like to yield to my colleague, the Ranking Republican Member, Mr. Lewis.

Mr. LEWIS. Thank you, Mr. Chairman.

Mr. Chairman, the two days of hearings on the FAA research budget and programs are very important for several reasons. First, we will reauthorize the programs for the next 2 to 5 years. Therefore, we must be able to accurately assess the strengths and weaknesses of the research over the near and long-term. Our witnesses will assist us in that process.

Second, this is the first opportunity the subcommittee has had to examine the adequacy of implementation of the Aviation Safety Research Act of 1988, in conjunction with reauthorization.

Yesterday, I visited the FAA Technical Center in Atlantic City. The progress of the R&D in fire safety, aviation security, and other programs has been very good. Nevertheless, the agency commitment to long-range R&D both with funding and scientific personnel is still lacking.

The need for more research in aviation safety increases. There is widespread support for increasing the FAA R&D programs both within the aviation community and with the flying public.

The subcommittee has already taken strong steps to increase the research in accident prevention with the passage of the Aircraft Catastrophic Failure Prevention Research Act of 1990.

I think the subcommittee will take additional strong action to insure an adequate R&D program based on hearing witnesses' testimony and our own examination of the programs, so I welcome today's witnesses and appreciate your interest and participation.

Thank you, Mr. Chairman.

Mr. TORRICELLI. Thank you, Mr. Lewis.

Mr. Campbell?

Mr. Campbell. Thank you, Mr. Chairman. I am also pleased to be part of the hearings today.

The question of noise is of great interest to constituents of mine around the San Francisco Airport, but particularly I want to draw attention to the importance of the work that we might do on the research on safety.

My concern is that, as questions of safety lead people to reconsider the wisdom of deregulation, we put at risk the savings from having abolished CAB, not only to the government but also to the consumer. So if FAA is doing its job properly and the flying public are reassured of the safety, I am hopeful we can continue to capture the benefits for the consumer and the taxpayer of having made the decision we did to eliminate the CAB.

With that in mind, I look forward to the witnesses and I thank the Chair.

Mr. Torricelli. Thank you.

Our first panel is regarding noise questions, that aspect of aviation that most members of Congress hear the most about. I do, but only on a daily basis.

[Laughter.]

Mr. Torricelli. Thomas Duffy is Executive Director of NOISE, and Diane Summerhays is Manager, Noise Abatement Program, Seattle-Tacoma International Airport.

Mr. Duffy, I recognize that you have some time constraints. I apologize that we've kept you waiting so long. Unfortunately, there were votes and none of us are in a position to dictate to the House when they will take place, but we appreciate your patience and welcome your testimony.

STATEMENT OF THOMAS DUFFY, EXECUTIVE DIRECTOR, NOISE

Mr. Duffy. Thank you, Mr. Chairman and members of the committee.

I am Tom Duffy, as the Chairman has said, Executive Director of the National Organization to Insure A Sound- controlled Environment. Somebody worked very hard, you will recognize, to get that acronym to work out to N.O.I.S.E.

We are an organization of city and county governments whose citizens are impacted by aviation noise. Therefore, we are near airports—usually somebody else's airport, as a matter of fact.

We are very rarely brought in in councils of this nature to comment on aviation matters and therefore, we are particularly grateful to the Chairman and the committee.

We are not selfish in our view about noise. My feeling is that aviation has one essential choke on its growth. That is its ability to increase its infrastructure and that is limited, in turn, by local political reaction to aviation noise. It is, therefore, I believe, a constructive step— both by government and by the industry—to work to reduce noise so that they can insure that aviation will continue to have its ability to develop as it has historically in this country.

I'd like to comment for a moment on the nature of research as did the Chairman.

The people who carry out research, applied research particularly, are in business doing what they do, and in aviation in this country, they do it very, very well. Therefore, they want to do more of it in the same way and it is very difficult to break out of the mindset of doing it in the same way and going to doing it in a different way. That will underlie the rest of my testimony this afternoon.

We are going to talk about three things—noise measurement and metrics, innovation itself, and en-route noise.

Metrics is a trade term for the way we measure aviation noise. It is an extremely important subject both to FAA, the regulator; to the airlines; to the airports; and to the communities that are impacted by airport noise.

It is not simple to do, to quantify noise, particularly made difficult by the way the acousticians do business. They speak in logarithms which is a language understood by nobody that I know of except themselves.

The decibel can't be added to another decibel, it can't be subtracted from another decibel. Oddly, if you add the number 10 to a decibel, you've doubled the sound involved or subtract 10 and you've cut it in half. Two equal sounds occurring at the same time only add three decibels and it doesn't matter how soft or how loud the sounds are, it is always three decibels if two equal sounds occur.

Things like this take it out of the realm of understanding of almost anyone except an engineer or a mathematician. So when FAA was made to choose a metric, it had a difficult thing to do, but it went ahead, judging all the best available things to it at those times, and they chose what is called a day/night sound level. The purest of the technicians call it DNL; everyone else in the world says LDN for reasons I don't understand.

It is, as you know, a 24-hour average sound level with a doubling of the sounds that occur between 10 p.m. and 7 a.m. and it's expressed on a yearly basis.

FAA has had it in use for several years, feels that it works well. Everybody knows how to work it now, knows how to do the formulas and run the programs. A lot of precedent had been built up and decisions are made by FAA in the noise field. They are not particularly inclined to change it.

It is a good system when used as it should be, as a general planning and analytic tool. But, when it is used as an absolute predictor of what a neighborhood should be reacting to, or how much it should be reacting to, or when it's used as an absolute decision-maker, saying the people on one side of a street get a benefit and people on the other side don't because a LDN number runs down the middle of that street, it is not a good system.

Communities feel that it doesn't do for their noise concerns or express their noise concerns nearly as well as it does decibels. They quote three main difficulties with LDN. It is so abstract that it is non-existent for any practical purpose to the community. It is inaccurate and it becomes completely irrelevant to what they are trying to say.

A typical LDN footprint plotted around an airport is generated by a computer program, the Integrated Noise Model— now I think probably in its 3.2, 3.3—several iterations long. It gets better and better as they go.

It requires the operator to make several assumptions which he feeds into the program. They include a certain number of aircraft operating into and out of an airport; they have to be of certain defined types; they have to be taking off and landing in a particular direction at a given time of day; and flying a defined distance when they take off.

If you expect sound to be predicted for a neighborhood with this kind of assumption, you've got a problem. Suppose on any given day, that many aircraft don't fly? Suppose they are bigger or smaller or louder or quieter airplanes? Suppose vegetation isn't right—it's spring instead of winter, or it's summer instead of spring and the vegetation has changed? It is impractical to say LDN is going to tell you what's happening.

In fact, on any given day, the average noise at a given place will never be what the LDN says it is. It varies so much back and forth that it just is never what it says it is. Unless, like a few airports around the country, you have sophisticated noise monitoring and computing equipment, you are just guessing at what it might be. A few airports do know what their LDN is and update it regularly.

Another thing you might say, a place like Aspen is certainly going to have a lot more aircraft in the winter than they do in the summer, and this LDN is just not useful then.

When somebody tries to tell me that LDN of a given number is going to tell me what my problem is, comes to my house and says, Tom, you've only got 60 LDN here, that's not really so bad. Why are you bothering us? I'm going to react very negatively to a question like that based on that kind of prediction.

Considering that the program itself has as many as 3 decibels of system error built-in, considering that all these assumptions we've been talking about may or may not be correct, considering time of year will change and other conditions, temperature, humidity, it is just not an accurate and useful system.

It is an average, as I pointed out earlier. What LDN says is that in effect, all year long, you've got a tone of so many decibels in your neighborhood or in your house. Now, you don't have that. The people who operate the system know they don't have that. The people in the neighborhood know they don't have that, but that's the kind of an abstraction that LDN is.

What does happen to people is the individual noise event. An airplane flies over, it stops discussion in the house, it stops telephone conversation, it disrupts a meal, people cannot be a family in the evenings when this happens to them and quite often, because of the way airports are operating nowadays, that is exactly the time when the heaviest aircraft traffic occurs.

It doesn't matter for the housewife from 9 to 12 in the morning, she doesn't have any aircraft problem because the problems still occur when the family is trying to be family at night. You can't say, well, it was okay in the morning and it's not okay at night and we have to average those out. So it doesn't relate well to the community.

It does relate well to what planners have to do. It gives them an idea of where to look for possible problems or where problems might crop up if they change aircraft operations at a given airport.

We need to develop for the use of the community and for planners some kind of supplements or refinements to LDN, the standard metric, the official metric. Are they out there now? No.

I've been to a couple of professional conferences lately and have heard suggestions made but no one claims to have a good substitute for LDN, or even any substitute.

There are things that people are looking at which will sharpen it considerably. There are a couple of systems of numeric accounting for noise rather than logarithmic. Simply being able to get a scale of numbers instead of a scale of exponents and being able to add and subtract them is going to help everybody concerned, if we can do it.

A very interesting technique called "SONES" takes the loudness, tone and frequency of a sound and tries to relate it to what it does to a human being and his annoyance. If we can develop that, it will make the measurement of sound, and sound as it impacts people, very much more useful.

Measurement systems in Minneapolis/St. Paul have come up with something called the L10 which, instead of taking the average day expressed over a year, it takes the heaviest 10 minute usage in a given neighborhood by overflights and concentrates on them.

They found that it identifies much more closely the difficulties that neighborhoods and people are having in those neighborhoods and identifies where the problems exist much better than LDN does.

In sum, I could say that current noise metrics are clearly deficient. there are ideas being proposed to improve them and potentially they look useful. We would recommend at NOISE that FAA be encouraged to follow that kind of research. That would be a big improvement.

Another phenomenon is en-route noise, something relatively new in the noise business. We didn't even hear about it until about 4 years ago. Right now, the current prime, major example is New Jersey.

The expanded East Coast Plan that FAA put into effect began to run aircraft across the state at altitudes of 8,000 to 10,000 feet in places where they had never heard or seen an airplane before. People, in fact, were living in central New Jersey because they wanted rural quiet environments around them and suddenly we have airplanes, even at altitude, producing noticeable noise. They notice it a lot.

There has been a massive—I would say almost brilliant — feat of community organization in New Jersey—media coverage, political pressure—and they've been using it to fight the noise problem.

I note that my testimony says "perceived noise problems" and I would put quotes around that on the theory that anybody who had a noise problem, it is real and not just perceived.

FAA was not prepared for the reaction. It's not in their book of regulations to consider anything above 3,000 feet. They thought there wouldn't be a reaction and were completely surprised and dismayed when it happened. They are trying to deal with it.

It is extremely difficult but this whole area of noise problems with LDN numbers of 50, which is roughly what it is in New Jersey as opposed to 65 or 70 which is what it is around airports, is something that none of us have much experience or knowledge about.

That is not the only example. The City of Seattle is going through a brand of it. Diane will be able to tell you about that. They are 15 miles from the airport out there. Planes are at altitude when they come over but suddenly they are getting a lot of sensitivity in neighborhoods in Seattle to noise like that.

A few years ago in the East Bay area of California, a shift of traffic patterns impacted towns 20 and 25 miles away from San Francisco Airport until through traffic rerouting, FAA was able to solve that one.

The unducted fan engine, which we have heard a lot about the last few years, one of its problems apparently was that it dragged a noise trail on the ground of over 50 decibels at cruise at altitude so that for the first time, we would have heard—if this thing had been sold a lot—airliners going over at altitude far away from an airport dumping 50 decibels loads on your house and you probably would never see the airplane. You'd just keep hearing this bump. That's another area.

I point this out because nobody knows very much about how to deal with en-route noise. It is a presenting problem that needs looking into.

The Chairman remarked on innovation. I would say that we would like to see some revolutionary rather than evolutionary innovation. The multiple microwave landing system is a good evolutionary idea but it is not revolutionary. There are other ideas out there. The Wayport is one and the way we would set up our airport system in the country and operate aviation. The tilt-rotor is another of the forms of technology.

A wildly radical airplane—you see the original tilt-rotor type model on the wall—now being developed is the V-22 for the Defense Department. Unfortunately they are running out of money and say they can't buy any but the virtue of both of these things may not be so much in the thing itself but in the fact that it is different and is forcing the government and the industry to think in different ways.

That is what we would recommend to the committee in looking at innovation. The revolutionary, the radical approach may have its own virtues.

I would ask the Chairman to enclose my written testimony in the record. I have abstracted from it.

[The prepared statement of Mr. Duffy follows:]

N.O.I.S.E.

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TESTIMONY OF

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National Organization to Insure a

Sound-controlled Environment

N.O.I.S.E.

before the

Subcommitte on

Transportation, Aviation and Materials

Congressman Robert G. Torricelli, Chairman

of the Committee on

Science, Space, and Technology

March 24, 1990

Good afternoon, Mr. Chairman and Members of the Committee. I am Tom Duffy, Executive Director of the National Organization to Insure a Sound-Controlled Environment. (The acronym is "N.O.I.S.E.")

N.O.I.S.E. is an organization of city and county governments whose citizens share the problem of aviation noise. It works, both nationally and locally, to reduce aviation noise and to abate its effects on communities. We are particularly grateful to be invited to testify here today. The point of view of the "noise consumer" is not always, indeed is rarely, heard in deliberations on aviation matters. But while we do have a particular point of view, I submit that it is neither parochial nor anti-aviation.

Local reaction to noise is the greatest obstacle to the increase in aviation infrastructure, either in new airports or in new runways. It is likely to remain so. If commercial aviation continues its historical increase in passengers carried, freight tonnage hauled and flights made, more infrastructure will need to be built. Noise, and the reaction it generates, may well be the essential choke on the development of that infrastructure and of aviation in the future. Dealing with noise is not just a response to self-serving demands of a vocal minority but a constructive step by government and by the industry itself to help insure that aviation will have the ability to continue its development.

It may be useful to offer a thought on the nature and motivation of applied research. The people who design and carry it out are the captives of what they have now or do now. All of us are, for that matter. The effect of this in designing research is to investigate things that will give us a stronger position on our own turf or that will let us do more of what we're doing now, but not to change the way we're doing it. This ingrained, natural tendency needs to be recognized so that research can be directed in ways which challenge the status quo, rather than entrenching it.

The Committee has asked that we suggest areas in which research may usefully be done by FAA.

We will comment on:

-- Noise measurement (metrics)
-- Innovation, itself with Wayports and the tilt-rotor as examples.
-- En-Route noise.

Metrics is the way that aviation noise is measured. It is extremely important to everyone concerned, not least communities. It is not a simple subject. No small part of the difficulty is the way acousticians label noise, in decibels. The decibel is a logarithmic expression which gives us such oddities as the fact that you can't add or subtract decibels or that a sound level which is ten decibels greater than another one produces twice as much sound (or if it's ten decibels less, half the sound.)

Starting with that, FAA had to choose a metric, a noise measurement system, which is expressed in decibels and which can be calculated to express the dimension of a community's aviation noise problem.

FAA chose the Day-Night Sound Level. (Correctly Abbreviated DNL; almost universally stated as L_{DN}. L_{DN} is a twenty-four hour average sound level, with noise events between 10:p.m. and 7:00 a.m. being counted double. This average is then given on a yearly basis.

FAA feels that L_{DN} works well and that various levels of L_{DN} can be correlated well with community annoyance. It is also a system that has been in use for quite a while. People are used to using it. A good deal of precedent has been built up with decisions based on it.

In fact, L_{DN} is a good system when used as a general planning and analytic device. When it is used as an absolute predictor of community concerns or as a precision tool for decision making, it is not so good. Communities often feel that it is not useful for defining their noise concerns nor for working toward solutions.

People who criticize L_{DN} say that it suffers from three main defects:
-- It is abstract to the point of being non-existent.
-- It is inaccurate.
-- It is irrelevant.

A typical L_{DN} plot (or "footprint") around an airport is generated by a computer program, the Integrated Noise Model. If the operator makes certain assumptions and feeds them into the INM, a footprint emerges. The assumptions include:

-- a certain number of aircraft, of
-- certain defined types
-- taking off or landing in a given direction
-- at a given time of day, and
-- flying a defined distance.

The practical problems with such assumptions are obvious. Suppose there are more or fewer aircraft? Suppose they're Stage 2 (louder) instead of Stage 3 (quieter)? Are there really going to be the same number of planes every day of the year? Apart from the few airports equipped with computerized noise monitoring systems, it is impractical to measure the daily average noise every day for a year.

Frankly, I'd question the process if someone came to my house and told me "Sir, you don't have much of a noise problem. You're only in the 63 L_{DN} area."

Considering that the INM program has as much as 3 decibels of system error, considering that the input assumptions may not be correct, considering that other variables such as wind, humidity, temperature, and the state of vegetation may not match standard conditions and considering that it may be off-season for the local airport, the L_{DN} figure does not describe what is happening on any one day at any given spot. This has been verified by setting out noise monitors. The daily average is virtually never what the L_{DN} predicts it to be.

This points up what is perhaps the most serious problem with L_{DN}, the fact that is a hypothetical average. What L_{DN} says, is that you have, year in and year out, an average noise so many decibels loud, in effect a constant buzz or tone.

Everyone knows that's not what happens. In fact, no one has ever heard the first decibel of L_{DN}. It is a concept, a mathematical abstraction not a sound.

What bothers people is the individual noise event, the single airplane over their house. When it's loud enough to stop conversations, to interrupt phone calls, to wake people up, its a problem. When these airplanes come one after another, the problem intensifies. Whether or not any airplanes come over the house from 9:00 a.m. till noon doesn't matter to families whose afternoons and evenings are disrupted.

L_{DN} relates well to planners needs. It does not relate to community needs. In order to do this, we need to develop supplements or refinements to current noise measurement systems to reflect actual household response to actual noise.

It's fair to ask whether there are any better systems than L_{DN} now. Answer: Probably not. There are indications that research can develop them. There are reports of work on acoustic measurements that are numeric, rather than logarithmic. Other work is being done on "SONES," a way of relating the annoyance value of a noise to its loudness and frequency. Measurement systems such as the L_{10} are being developed in Minneapolis-St. Paul. The single event needs more work to develop objective annoyance measures.

Current noise metrics are deficient. There are ideas around for improving them. This is potentially a very useful avenue of research. We recommend an emphasis on it.

New Jersey is an example of a relatively new phenomenon, En-route noise. This is aviation noise which is not directly associated with operations at a particular airport. FAA's Expanded East Coast Plan, designed to reduce congestion and delay at the Port Authority airports near New York, shifted air traffic onto routes crossing central New Jersey. Aircraft were at altitude (8,000 or 10,000 feet or more), but they did produce noticeable noise. And notice it the residents did. For the last two years, there has been a massive outcry from the residents there.

Community organization, media coverage and political pressure have been used to fight the perceived noise problem. FAA was, and is, nonplused. This is a totally new problem. By any previous measure or experience, it shouldn't exist. But it does exist. This is another instance where L_{DN} leads as astray. An L_{DN} of 50 or so, when compared to near-airport problems where L_{DN} readings reach into the 70's and 80's. Why this is the problem it is and how to deal with it are very obvious subjects for research.

New Jersey is the prime example of En-route noise, but it is not the only one. A similar instance happened in the East Bay area of Northen California a couple of years ago. FAA was able to resolve it, for the most part.

Seattle now has a similar problem. Downtown residents fifteen miles from SEATAC airport are complaining about noise. One of the problems with the newly developed external fan engine (undected fan; ultra-high bypass.) is that an aircraft crossing at altitude leaves a sound trail behind it on the order of 50-60 dB. Again, this is a new problem, one well worth looking into.

There are some areas of innovation that have a bearing on aviation noise. We would like to bring them to the Committee's attention.

One is evolutionary, the Microwave landing System (MLS). This system's capability to move air traffic on curved approaches offers the possibility of moving aircraft near airports around the most particularly noise sensitive neighborhoods. Although this system is well along in development, it is not yet on line. We would like to see its noise potential pursued.

Revolutionary innovation offers some very bright prospects, but is very hard to get on anyone's research agenda. As commented I earlier, our aviation industry is a magnificent operation, an example of cooperation among the industry, the federal government and airport operators. Progress is seen to be more of what we're doing now, not necessarily doing something else.

One example is the Wayport idea. N.O.I.S.E. has looked at it with interest but does not have the skills or resources to do extensive investigation or analysis. FAA and industry figures have looked at the idea. The answer so far is to dismiss the idea. Our impression is that these investigations are pro-forma.

Wayports are not the way that the aviation business is done now. The industry points with deserved pride to the truly magnificent operation of the US air carrier fleet and says, "This is the way it should be done." This same industry views with alarm the static state of aviation infrastructure, asking how future aviation development will be accommodated.

We submit that change will be necessary in aviation's future. The Wayport, whatever is virtues or defects, is at least an idea. The fact that it's radical may be one of the best things about it. It needs to be looked at in depth.

Innovation needs to be pursued in technology as well as in systems. The tilt-rotor is a good example of this. Again, the change in technology is radical, so radical that much of the way the aviation business is done would change if tilt-rotor aircraft become common.

Most of the development costs have been paid by the Defense budget with the V-22 and its predecessor.

The Defense Depatment is trying to withdraw its support of the program for budgetary reasons. No one appears to be taking up the slack. Yet a preliminary study by the Port Authority of New York and New Jersey showed that the tilt rotor would radically change short to medium range aviation. Their prediction was that a civilian version of the V-22 could transport passengers from downtown New york City to downtown Washington in about thirty eight minutes. This kind of time saving over the shuttle would by itself be worth a premium price.

An added advantage is that the tilt rotor would be operating in now underused airspace and from its own bases. This would be a major relief from congestion in both airspace and airports.

Reports on sound emission for the V-22 are also good. Coupled with the tilt-rotor's ability for vertical or near-vertical ascent and descent, there could be real improvement in noise performance over today's jets that fly the same stage-lengths.

Early work by FAA coupled the idea of six Wayports and the tilt-rotor's three hundred mile operating radious and found that more than 95% of the area of the US would be covered. With the potential that such ideas offer, they need to be looked at further.

Again, N.O.I.S.E. does not have the expertise or resources to make definitive judgements on these concepts. We do suggest that they, and perhaps others like them, can offer considerable promise as research subjects. They also reinforce our recommendation that innovation can be its own virtue.

Mr. Chairman, on behalf of the local governments who constitute N.O.I.S.E, I thank you again for the opportunity to appear before the Committee today. Should you have any questions, I would be happy to address them.

Mr. **Torricelli**. Thank you, Mr. Duffy, for your testimony.

Mr. Duffy, what time do you need to depart?

Mr. **Duffy**. In about 10 minutes, sir.

Mr. **Torricelli**. How long is your testimony, Ms. Summerhays?

Ms. **Summerhays**. Five or six minutes.

Mr. **Torricelli**. Why don't you proceed?

STATEMENT OF DIANE SUMMERHAYS, MANAGER, NOISE ABATEMENT PROGRAM, SEATTLE-TACOMA INTERNATIONAL AIRPORT

Ms. **Summerhays**. Mr. Chairman and members of the committee, my name is Diane Summerhays. I manage the Noise Abatement Program for Seattle-Tacoma International Airport. We want to thank you for giving the Port of Seattle this opportunity to address you on noise and the FAA.

Sea-Tac has a long history of working with the FAA in airport noise mitigation, starting in the mid-1970s with home acquisition through the 1980s with a Part 150 Program and most recently, a mediation process in which the FAA participated with the Port and others in actively negotiating some new noise reduction programs for Sea-Tac.

In addition, earlier this month the FAA implemented major changes to arrival routes over the greater Seattle metropolitan area and this action brought us into a very close association with the FAA, as I am sure you can imagine.

So, fresh from our most recent experiences, I am offering here some of our comments on approaches and tools that the FAA should consider in assisting airports with their noise abatement efforts.

Tom talked about noise descripters and I'm going to say a few words too. How noise is described is important in achieving credibility for a noise abatement plan with the community. The LDN descripter, while accepted industrywide, is not accepted by residents as accurately describing their own personal experiences.

While continuing to use LDN, airports need supplemental metrics that can help in painting a noise picture that is more understandable to communities. Seattle area residents want consideration given to looking at single event noise, ambient noise levels and LDN contours that show a seasonal or other focused impact.

I guess along with citing garbage dumps or prisons, I don't know of anything more controversial than changing flight patterns over a city. I'd like to just touch a little bit on a process that I think could be helpful.

In Seattle, after the FAA proposed flight track changes, but before they implemented them, they took some productive actions. They sent a very high level official throughout the community to give presentations to any group that wanted them; they continued participation in our mediation process; and postponed implementation of their plan while the citizens considered noise-related modifications. They issued an environmental assessment, a formal environmental assessment to see if they should do an EIS and then they held a public hearing.

Flight track changes will increasingly be discussed nationwide as the capacity issue intensifies. FAA's sensitivity to noise while they are considering these changes — not after the fact—is critical if the general public is to continue supporting the growth of the aviation industry and the air transportation system.

While considering changes, the FAA process should fully consider probable noise effects of proposed route changes. Even if an EIS is not required, the FAA should have some idea before they go out publicly what the impacts are going to be.

They should, through a credible public process, give a full description of the changes and articulate the Federal interest in these changes so people understand where they are coming from. They should include special attention to areas that are likely to have concerns.

Finally, where opportunities for noise mitigation exists, the FAA should put those into their plan right from the outset and not wait until the debate gets so heated that people don't even want to hear about it.

Citizens are very concerned about where aircraft fly and they want to know what to expect. Many airports such as Sea- Tac feel that monitoring flight tracks is an important part of noise abatement, but to do this on a constant basis and in an objective manner, it is necessary to have access to the FAA's radar data for a particular airport. This data is called ARTS data and comes from the radar.

What it does is it allows an airport to research complaints and then to come back to the air traffic controllers and the airlines with evidence about existing or developing problems of nonadherence to a procedure.

Because this data provides the over-the-ground routes, altitudes and identification of any aircraft, it can be used to assure citizens that the FAA and airport are keeping their promises about flight patterns. I know some airports have had good success using this to get a flight track changed by saying we have this tool available, if we make this change, we'll be able to look and see if we are actually doing what we said we would do.

ARTS, therefore, should be provided to airports and ARTS processing systems made eligible for Federal funding.

I want to touch just one minute on the microwave landing system. At Sea-Tac for some time, we've been interested in the options and the flexibility that an MLS might offer for noise abatement because of one of our noise abatement routes. In fact, through our recent mediation process, we recommended that Sea-Tac become a demonstration airport.

I am reinforcing that recommendation here and suggesting that maybe other airports and the FAA would want to look at the application of MLS and get some support through the local citizens for that aid.

Finally, I would like to conclude with some observations on FAA process and procedures that should be considered.

With no national noise policy on the horizon, more airports will see aggressive use restriction programs in response to a growing vocal and politicized constituency. This trend could place serious constraints on the air traffic system and upset the balance between protection against severe noise impact and the need for consistency in regulations pertaining to interstate commerce.

It is essential that the FAA participate actively in the development of noise-related use restrictions so that this balance is preserved. Such participation can help airports and their neighbors understand what kinds of restrictions are most appropriate for a given airport and can insure that the U.S. does not develop what we've been calling a "crazy quilt" of regulations that prevent the system's ability to work properly.

The FAA should try this kind of participation and then if that doesn't work, they can resort to their traditional role of comment, refusal of funds, or litigation in the public interest.

That concludes my comments, Mr. Chairman, and I would like my written statement to be part of the record.

[The prepared statement of Ms. Summerhays follows:]

Port of Seattle

TESTIMONY TO THE U.S. HOUSE OF REPRESENTATIVES
COMMITTEE ON SCIENCE, SPACE AND TECHNOLOGY
Subcommittee on Transportation, Aviation and Materials
Robert G. Torricelli, Chairman

Presentation by Ms. Diane Summerhays, Noise Abatement Officer,
Seattle-Tacoma International Airport, Port of Seattle
Seattle, Washington
April 24, 1990

Thank you Mr. Chairman and subcommittee members for inviting the Port of Seattle, operator of Seattle-Tacoma International Airport (Sea-Tac), to address you on aircraft noise reduction. I will briefly explain Sea-Tac's noise programs and some of our thoughts on how the FAA might further assist airports in these efforts.

SEA-TAC'S NOISE PROGRAMS

Sea-Tac has been involved in noise mitigation since the mid-1970s and in the 1980s has developed and implemented its programs under Federal Aviation Regulation Part 150. Citizen involvement has been central to Sea-Tac's noise reduction efforts and was critical to our recent success in reaching a negotiated agreement on additional noise abatement programs for Sea-Tac.

Sea-Tac acquires homes in severely noise impacted areas and relocates the residents, provides sound insulation, assists homeowners in selling their homes, operates a noise monitoring system, noise complaint line and flight track sampling system to monitor compliance with noise abatement procedures, enforces run-up regulations and provides public information materials.

We are initiating implementation plans for programs that resulted from our recently negotiated noise abatement agreement. This required consensus by the airlines, FAA, community representatives, Port, pilots and business interests. The cornerstone of the Sea-Tac agreement is the combined use restrictions: a noise budget and nighttime restrictions on Stage 2 aircraft. When these programs are in force, Sea-Tac will have one of the most comprehensive noise reduction plans in the country, resulting in our ability to cut noise at Sea-Tac by 50% by the year 2001.

Since the mid-70s, the FAA has worked closely with the Port of Seattle in our noise abatement efforts. These years of collaboration have provided us with a good perspective on what actions the FAA should take to further assist airports in noise reduction actions.

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DESCRIBING NOISE

LDN is a flexible and credible noise metric. However, because it is an annual average of noise, it is not viewed by residents as accurately describing their own personal experience. We recommend the FAA evaluate and adopt supplemental metrics that can be used in conjunction with LDN to paint a "noise picture" that is more understandable and acceptable to impacted communities . Our experience at Sea-Tac indicates that residents are particularly interested in meaningful data that reflects single event noise, ambient noise levels, and LDN contours that show seasonal or other focused impacts in addition to those based on the yearly average calculations. For industry-wide consistency, the development of supportive descriptors must be coordinated with other agencies concerned with environmental noise impacts.

EVALUATING FLIGHT PATTERNS

Changes to Flight Patterns

The FAA recently changed flight patterns in the greater Seattle metropolitan area to reduce delays and air traffic congestion, maintain a high level of safety and more efficiently use both of Sea-Tac's runways. After publicly proposing this change, the FAA took some productive actions: it sent speakers to any community group requesting a presentation, continued participation in Sea-Tac's Mediation Committee and postponed implementation to allow the committee time to consider noise-related modifications, issued an environmental assessment and held a public hearing. All these actions were, in the airport's opinion, necessary.

With capacity issues increasingly forcing consideration of flight track changes, we feel an approach by the FAA indicating sensitivity to noise is crucial to achieving support for the aviation industry in general. Realizing that the FAA's primary concerns are safety and efficiency, we nevertheless recommend that the FAA more fully consider the probable noise effects of proposed changes to routes, even if formal documentation is not required. The FAA should completely describe these changes through a credible public process, discussing the proposal in particular with areas likely to have concerns. It is important that the FAA be specific in defining its interests in making the changes, and, where there is an opportunity to mitigate noise, make it a part of the plan from the outset.

Monitoring Flight Patterns

A number of airports, including Sea-Tac, have determined that access to the FAA's radar data, called ARTS data (Automated Radar Terminal System) is crucial to credible monitoring of noise abatement procedures. This data allows airports to research complaints, identify problems and produce objective information that can be used in discussions with the air traffic controllers, airlines and the community. It can be used to assure citizens that promises made by the FAA or the airport concerning flight patterns are being closely watched and can provide the evidence that public agencies are acting in good faith.

We recommend that the FAA develop policies and mechanisms to provide ARTS data for airport flight track monitoring efforts and that systems developed by airports be eligible for federal funding through FAR Part 150 study.

Microwave Landing System

At Sea-Tac, residents and the airport have long been interested in the possible options for noise reduction that a microwave landing system may provide and, for this reason, the Mediation Committee recommended that the FAA designate Sea-Tac as a demonstration project for the Microwave Landing System. We would like to reinforce that recommendation in our comments here.

ARTICULATING THE FEDERAL INTEREST

Several years back the FAA said it might provide a national policy on airport access and capacity issues to address what it called "ad hoc" access and use programs. It does not now appear that a comprehensive federal policy on aircraft noise and airport access is likely in the near future. In the absence of such a policy, airports will increasingly seek aggressive airport use restriction programs in response to a growing vocal and politicized constituency. If this trend continues, the national air transportation system may experience serious constraints while the delicate balance between protection against noise impacts and that of interstate commerce requiring consistent regulations may become upset.

It is, therefore, essential that the FAA participate actively in the development of noise-related use restrictions so that balance is preserved. The FAA's role in these activities should include identifying combinations of service levels, facilities and capacities that the national system needs to work properly. For example, certain airports such as Sea-Tac serve as a sole regional air carrier facility. What Sea-Tac can tolerate in terms of noise restrictions may be very different from what John Wayne Airport in Southern California can impose as this airport enjoys alternatives for service to the region. By identifying and documenting varying conditions within a national framework, the federal role can help airports develop noise reduction solutions that do not result in a "crazy quilt" of regulations. We envision a process in which the FAA comments during discussions of such programs. The FAA can then determine that a proposed restriction does not adequately protect the national interest or can state that a process is not being correctly pursued. If this type of participation does not work, then the FAA can resort to its traditional role of comment, refusal of funds, or litigation in the national public interest.1

Having gone through a public discussion of a noise budget and limitations on the use of Stage 2 aircraft at night, we recommend that procedures be developed requiring that the FAA actively participate with the airport operator during developement of such programs and that this participation include clear articulation of the federal government's interest in these matters.

This concludes my statement, and I thank you once again for this opportunity.

1. (Kimberly J. Johnson, Transportation Research Record 1218)

Mr. TORRICELLI. Thank you.

Mr. Duffy, is the Minnesota measurement that you cited the only example of which you are aware that you have confidence there has been a better measurement technique used?

Mr. DUFFY. The single event level is also used. In answer to your question, L10 is probably the best average level measurement I've seen used so far. The single event is used on occasion and is desired to be used more by many neighborhoods, as Ms. Summerhays points out. What I am saying is that there are indications of better things that can be developed and I'm recommending that FAA take that step.

Mr. TORRICELLI. Therefore, for the committee's purposes in authorizing future FAA activities, are you suggesting that the FAA be directed to either externally or internally devise new measurement methods?

Mr. DUFFY. Yes, sir, to seek out those options which are out there now or are being suggested by the—

Mr. TORRICELLI. Either on single event or in general measurement?

Mr. DUFFY. Both.

Mr. TORRICELLI. In fact, community groups that are organizing around airports, are they being refused access to radar information or is that just occasional?

Ms. SUMMERHAYS. At Sea-Tac we have the radar information. I have heard from other airports that they have had some difficulty in acquiring the ARTS. Our regional FAA has been very supportive.

Mr. TORRICELLI. FAA officials have refused access to the information?

Ms. SUMMERHAYS. I have heard from other airports that they have had trouble getting it. I don't know the specifics of those interactions.

Mr. DUFFY. At other airports, Mr. Chairman, we have heard that FAA has been very obstructive in doing so and if there is an incident, they may never release that data. By the way, all data is 14 days late at minimum.

Mr. TORRICELLI. Mr. Duffy, help me understand, if you could. I am sometimes surprised by constituents of mine who will live by a busy highway with trucks that will roll all hours of the night; next to a fast food restaurant where people will honk their horns at each other or just to hear the melodious sounds; and yet they will complain about aircraft. Is this something in our modern culture or is there some aspect of aircraft noise that seems to make it particularly objectionable?

Mr. DUFFY. If, as I think you're suggesting, equal noises being equal, why do they talk about the airplane?

Mr. TORRICELLI. The reality is that they do.

Mr. DUFFY. And, in fact, they do.

One theory I've heard from psychologists is that we're seeing fear being expressed with noise as its proxy. People are flat scared of airplanes over their heads and are worried about them falling down, and that feeds the noise image. Also, you can point to that airplane, by the way.

Mr. Torricelli. Yes, it is identifiable, but there is nothing in your experience peculiar about aircraft noise that makes it more objectionable than things we live with every other day?

Mr. Duffy. Not qualitatively, no, sir. The acousticians tell me that it's not all that much different from a lot of other noise.

Mr. Torricelli. Mr. Lewis?

Mr. Lewis. I'd like to ask you both if you know of any movement afoot at this time to come up with better noise measurement descripters?

Mr. Duffy. FAA resists any such suggestion. They say, we have a system, it works, and it's related to community response.

Mr. Lewis. As you pointed out, most housewives and homemakers are not engineers and they don't understand those metric logarithmic descriptions, LDNs and things like that. They might think an LDN is something to look at when they put on a pair of shoes or something like that.

Ms. Summerhays. In Seattle, one of the things we did in our recent mediation process was use some supplemental metrics. We used LDN but then we did seasonal contours which showed people that, for instance, during a north flow departure pattern, they were getting a much bigger impact than they were when the planes went the other direction, and the most impact was felt during the summer.

So we were able to use some supplemental ways of showing people that we could recognize the noise impact they had and what times of year they were having it. We used single event.

There have been some attempts to correlate frequency and you talked about noise levels and why people complain about airplanes but maybe not about trucks that could be louder— you talked about 50 decibels. In fact, we think there is a frequency factor that really bothers people; that they might not notice airplanes and then they get growth and it hits a certain point and that is the point after which they hear every single one.

There has been some attempt, I think, on the part of Minneapolis in looking at trying to quantify the frequency of an aircraft over flight affects peoples' perceptions of noise.

Mr. Lewis. This is true. Frequency has a lot to do with a jet aircraft in the 4,000, 5,000, 6,000, 8,000 cycle ranges—

Ms. Summerhays. Oh, it does, sure.

Mr. Lewis. Just like certain women's voices irritate men sometimes just because of the frequency.

Ms. Summerhays. Frequency, duration of noise.

[Laughter.]

Mr. Lewis. And they really aren't mad at the woman, it's just the fact they get irritated because of that.

I noticed in your testimony about approaches, both landing and takeoff approaches, in order to reduce the noise in certain areas?

Ms. Summerhays. We have a noise abatement procedure that brings aircraft in through the Bay. Through our latest program, we are trying to improve that, improve the accuracy of that.

One of the main problems with this FAA change in routing is because of so many delays Sea-Tac had, they had to take a lot of planes and bring in another direction so that they had a dual arrival stream. That was a big problem.

Mr. LEWIS. Did the airlines object to this?

Ms. SUMMERHAYS. To the new pattern? No. In fact, the airlines said that this was very important to them and that getting this pattern was one way they were going to be able to sell these new noise programs that we just negotiated. It was very important to the airlines that they have this new pattern.

Mr. LEWIS. I know here in Washington, back during World War II—which you don't remember—fighter aircraft when they were strafing used to do what was called a snake dance and fly into targets like that to avoid ground fire. Well, we do that here every time we land at Washington National down the Potomac. In my judgment, that is a very unsafe mode to put those large aircraft in that close to buildings.

Ms. SUMMERHAYS. I noticed that last night.

Mr. LEWIS. I just wonder what NOISE has done to look at these approaches, both fanning, taking off, as well as snaking down rivers coming in to land and how you balance the safety aspect with the noise reductions?

Mr. DUFFY. We cooperate with and defer to the Airline Pilots Association on that. They are our best guarantors of the safety of the procedure. We have worked with them quite often in discussing this kind of thing.

We say there is no noise procedure which should be taken if it is not safe. This is the ultimate necessary thing about aviation.

Mr. LEWIS. Has any university, anyone in academia come up with a method of measuring noise different than the current method?

Mr. DUFFY. You measure noise directly in actual decibels.

Mr. LEWIS. I mean describe and apply what you've measured, a different type of scale, so that the layman can understand?

Mr. DUFFY. As I said, there are some systems being proposed like SONES which will attempt to combine irritation and loudness and repetition rate into some kind of factor that will do that. They are theoretical and offered; they are not generally accepted in the academic community.

Ms. SUMMERHAYS. The research has to correlate community response to the kind of noise they are hearing. That research was done quite a while ago and resulted in the LDN. I think there probably needs to be a new round of research that says these are all the noise programs everybody is doing to mitigate, but really what is it about noise that really bothers people and do these two things match.

I think there hasn't been something recent like that done and that might be something the FAA would want to look at because we have some very standard approaches to noise abatement we use. We are assuming they are what people want to see.

Mr. LEWIS. Thank you, Mr. Chairman.

Mr. TORRICELLI. Thank you, Mr. Lewis.

Mr. Campbell?

Mr. CAMPBELL. Thank you, Mr. Chairman.

Mr. Duffy, I'm aware of your flight and if you have to leave, I'll forgive you and I'm sure the Chairman will do.

Mr. DUFFY. As a San Franciscan, sir, I would be happy to answer anything.

Mr. **Campbell**. Thank you, I'm delighted. Wait a minute, are you a constituent?

[Laughter.]

Mr. **Duffy**. No, but I am one of the few people who can say that he was not only born there but his father was too.

Mr. **Campbell**. That's remarkable. I am very pleased then you're willing to stay.

I wanted to ask you about the microwave landing system which is in your prepared testimony and Ms. Summerhays addressed it as well.

I'd like to know, if you could, just a brief sketch of its technological feasibility and the safety component of using it. You mentioned in your testimony that it hasn't yet been implemented. I'd like to know where it is and what I have in mind is SFO.

Mr. **Duffy**. It is about ready to be up and running. There has been a lot of difficulty because the equipment is very expensive. Forcing airlines to put it in their aircraft if it is only being used at four airports in the country, they find that very expensive and not practical. Most of the difficulty has been with questions like that rather than technological feasibility and safety.

Mr. **Campbell**. Can you give me a little bit more of a description? It allows the air traffic controller to direct the incoming or the outgoing flight in much more detail around neighborhoods?

Mr. **Duffy**. If you can conceive of an instrument landing system which brings an airplane down on a straight line, this sets up a situation where it is a curved line and can be made to curve in a given direction. You don't do it arbitrarily; all the electronics are set up and everybody follows that pattern.

Mr. **Campbell**. So it is comparable to what my colleague from Florida, our Vice Chairman, described as a snake dance except this time with the benefit of electronic guidance.

Lastly, what are the airports at which this is being proposed? Do you happen to know?

Mr. **Duffy**. I don't know for certain.

Mr. **Campbell**. Ms. Summerhays, do you have anything to add on this topic generally or on the question of what airports?

Ms. **Summerhays**. No. I know that there is a schedule that was supposed to be in effect in 1991 and I think Sea-Tac was on that. There were 10 airports but I don't know what the status is of that at this time. I think MLS is used a little bit in Alaska for some steep approaches.

Mr. **Campbell**. It is certainly worth pursuing and I shall do so.

I want to thank you and just draw one obvious conclusion, the similar between the Richter scale and the decibels is they are both exponential and also the two events that cause Californians the most degree of complaint.

Thank you, Mr. Chairman.

Mr. **Torricelli**. Speaking of the Richter scale, Mr. Rohrabacher from California?

[Laughter.]

Mr. **Rohrabacher**. Thank you.

If I can just ask a general question, Mr. Duffy, in the future—and I am sorry I was late for this meeting today and if you have already covered this, I apologize—could you tell us in the future what level of progress you expect in terms of engine noise? Do you expect that in 5 years or 10 years from now we'll have a 50 percent reduction or how would you characterize it?

Mr. DUFFY. There are no technological developments on the horizon which will give us significant reductions below what the best engines now are producing. We just don't see anything like that.

Mr. ROHRABACHER. The research that is taking place now, you are not very optimistic that that research is going to come up with something in the next couple of years that will do this as well?

Mr. DUFFY. As I said, at this point, nobody can show me where that might be happening.

Mr. ROHRABACHER. Thank you very much. That's all I have.

Mr. TORRICELLI. Mr. Duffy, if, however, there were no 727s or DC9s today in the national fleet, would we be hearing anywhere near the current level of uproar from the public about noise around many of these airports?

Mr. DUFFY. It would go down dramatically. FAA projects something over 3 million people within 65 decibels LDN right now. They say if we went to an all Stage Three Fleet, it would be about 1 million.

Mr. TORRICELLI. So just in modernization of the fleet, there would be a dramatic difference in what many of us are now hearing?

Mr. DUFFY. Yes, sir. Not completely solving the problem, but moderating it to a very great degree.

Mr. TORRICELLI. Do either of you have a suggestion as to why the Administration removed its noise component from the National Transportation Policy?

Mr. DUFFY. As to the three-legged stool, the all Stage Three Fleet, I don't know why they did that. As to a moratorium on the ability of airports to take certain measures to restrict noise there and as to land use around airports being taken away from local governments, I know that our local government associations—National League of Cities, National Association of Counties, U.S. Conference of Mayors and NOISE - - protested that very strongly to the Secretary very early this year. There may be or may not be a cause and effect result.

Mr. TORRICELLI. They protested the maintenance of restrictions on the use of land?

Mr. DUFFY. They protested taking away the powers of local government to one, do restrictions on the part of airports and airport authorities; and two, conduct their own land use and zoning affairs.

Mr. TORRICELLI. That is a real tragedy. I know from my own experience, a recurring problem is that people build a home or establish a company directly next to an airport, move in and the next day call my office complaining about the noise. One cannot resist the temptation to tell them, you didn't notice? It was not apparent to you that there was an airport next to your home?

Anyway, it is a lost opportunity and I regret the Administration did not include it.

Thank you both for your testimony. I appreciate your time and Mr. Duffy, I hope you make your plane back to San Francisco.

Mr. DUFFY. Thank you.

Mr. TORRICELLI. Our next panel, please. Mr. James Gormley is President, General Aviation Manufacturers Association. William

Hoover is Executive Vice President, Operations and Safety, Air Transport Association of America. John O'Brien is Director, Engineering and Air Safety, Air Line Pilots Association. Siegbert Poritzky is Vice President, Technical Affairs, Airport Operators Council International. Steven Brown is Vice President, Strategic Planning and Policy, Aircraft Owners and Pilots Association.

I understand Mr. Gormley and Mr. Brown, each of you will be making opening statements. Others have indicated a desire to offer comments only. Please do remember, however, if you have opening comments, they can be submitted and will be submitted for the record in their entirety.

In the interest of time so that we can have the maximum amount of time available to have questions, I would appreciate your keeping your opening comments as brief as possible.

Mr. Gormley?

STATEMENT OF JAMES D. GORMLEY, PRESIDENT, GENERAL AVIATION MANUFACTURERS ASSOCIATION, NATIONAL AVIATION COALITION

Mr. **Gormley**. Good afternoon, Mr. Chairman, members of the committee.

I am Jim Gormley, President, General Aviation Manufacturers Association, but today I am privileged to appear before the subcommittee on behalf of a number of aviation organizations. They include the Aerospace Industries Association, the Air Line Pilots Association, the Airport Operators Council International, the Air Traffic Control Association, the American Association of Airport Executives, the General Aviation Manufacturers Association; the National Aeronautic Association, the National Association of State Aviation Officials, the National Air Transportation Association, the National Business Aircraft Association and the Regional Airline Association.

Our detailed statement is too long and too complex to cover in any detail, so I ask that it be included in the record and I will try to summarize.

Mr. **Torricelli**. Without objection, so ordered.

Mr. **Gormley**. Today, we find ourselves at a critical juncture in the FAA RE&D program with a new FAA Administrator, an important functional realignment of the RE&D activity, a new recognition of the importance of a viable R&D program within the FAA, and, I might add, a new Chairman of our authorizing subcommittee.

We applaud and strongly support FAA's decision to create a meaningful RE&D program driven by seven major thrusts. They are pointed at aircraft safety technology, capacity and ATC technology, system security technology, human factors, atmospheric environment, communications, navigation and surveillance, and airport improvement.

We strongly support the FAA Administrator's recently announced paper "A Vision of the Future, The ATC System Beyond the NAS Plan." This is a valuable blueprint for the future that reflects the views not only of the FAA but of the U.S. industry and of governments around the world. It deserves to be the basis of FAA's RE&D efforts for the future.

This paper contains some guiding parameters which will help frame what we see as a three-fold FAA mission: to conduct research, engineering and development to improve and refine the aviation technical infrastructure, aircraft operations and air traffic controls, and the tools which support them; to conduct and sponsor research on aircraft and airman safety, with special emphasis on aging aircraft; and third, to look beyond at the evolution of the aviation system for the future and to undertake the research and development efforts to bring that future into being to serve mankind.

To accomplish what must be done, we believe a funding level of $260 million per year for fiscal years 1991 to 1995 is appropriate and needed.

From a historical perspective, RE&D funding has fared quite well in the last few years and the FAA fiscal year 1991 request is for a respectable $190 million. Unfortunately, for a number of years, RE&D money did not go into research or development. Following publication of the National Aerospace System Plan in 1982, the money was allocated to the NAS Plan elements—important, but not R&D. Moreover, the organizational will and capacity to carry out real R&D withered because people were needed to carry out the NAS Plan work and little else.

In the hearings on the 1990 FAA RE&D budget, several witnesses reported positive signs of hope for progress. This year, while that effort is still in its infancy and the rate of recovery has been slow, there is important organizational progress.

First, the new FAA realignment appears to show that management is serious about reestablishment of a meaningful development capability. Secondly, establishment of a sensible, perhaps definable, division between system engineering and programs and NAS development is indeed promising.

Third, putting essentially all technical development activity into one organizational structure is important. Fourth, recognizing the need for a system design group is a major step. Finally, the decision to establish peer groups of experts to advise FAA on the several major components of its RE&D efforts is certainly constructive.

We are indeed encouraged by FAA efforts to organize and improve their R&D process. Recognition of the need for a cadre of technologists, emphasis on development rather than long-term research and the application of emerging technologies can lead to many needed system enhancements.

We encourage this committee to authorize the levels of funding necessary to enable the FAA to meet the challenges it faces and to exercise your oversight jurisdiction to insure that the funds and necessary efforts are expended properly.

We have included a number of recommendations in our statement. We have also included a number of recommendations on funding for the next authorization cycle. I would like to highlight them because they are vitally important.

The DOT/FAA authorization request specifies $190 million for fiscal year 1991 with $195 million for each of the succeeding 4 years. The industry, recognizing the deferred or neglected efforts of recent years and the many challenges that lie ahead, recommends a level of $260 million in each of the next 5 years.

We are convinced that the introduction of air traffic control automation, the exploitation of various new technologies and their introduction, and numerous related transitional challenges will demand an intensive, well-funded effort.

The growing recognition that RE&D does not end with feasibility demonstrations but includes everything else en route to implementation, underscores the need for increased funding.

While we perceive that the majority of FAA's efforts to be directed at development rather than research, we think that some percentage of FAA expenditures—perhaps in the 15 percent range—should be devoted to the research and analysis of safety issues, air traffic control enhancement and human factors. After all, the RE&D cycle starts with research and this essential ingredient must be maintained.

The proposed annual authorization level of $260 million is not an arbitrary one, Mr. Chairman. The industry has analyzed the DOT/FAA request and has identified additional funding requirements in a number of areas. These are spelled out on pages 10 and 11 of our prepared statement.

Additional findings and recommendations are included in the attachments to the statement. Time simply does not permit us to discuss them individually.

This concludes my summary of our statement, Mr. Chairman. My colleagues and I will be pleased to respond to your questions.

[The prepared statement of Mr. Gormley follows:]

STATEMENT OF JAMES D. GORMLEY

President

Of The

General Aviation Manufacturers Association

On Behalf Of:

Aerospace Industries Association of America
Air Line Pilots Association
Airport Operators Council International
Air Traffic Control Association
Air Transport Association of America
American Association of Airport Executives
General Aviation Manufacturers Association
National Aeronautic Association
National Association of State Aviation Officials
National Air Transportation Association
National Business Aircraft Association
Regional Airline Association

FAA R, E & D REAUTHORIZATION

Before the House Committee on Science, Space and Technology
Subcommittee on Transportation, Aviation and Materials

April 24, 1990

FAA R,E&D REAUTHORIZATION

Good afternoon. My name is James Gormley, and I am pleased to appear before this Subcommittee on behalf of AAAE, AIA, ALPA, AOCI, ATA, ATCA, GAMA, NAA, NASAO, NATA, NBAA and RAA.

We find ourselves at a critical juncture in the FAA R,E&D program with a new FAA Administrator, an important functional realignment of the R,E&D activity, and a new recognition of the importance of a viable R&D program in FAA.

We applaud and strongly support FAA's decision to create a meaningful program driven by seven major thrusts, described by FAA as follows:

> **Aircraft Safety Technology** -- Projects in this area will enhance aviation safety through technology improvements that address regulatory issues such as noise abatement, aging aircraft, engine maintenance, fire protection, flight safety, and other related needs.
>
> **Capacity and ATC Technology** -- These projects will increase the capacity and utilization of airspace and airport resources in a safe manner, achieve automation of the enroute and terminal ATC and flow management process, and enable as many aircraft as possible to select their preferred flight profiles.
>
> **System Security Technology** -- These projects will enhance the security of passengers and crews in all aspects of aircraft, airports, and related ATC activities.
>
> **Human Factors** -- Human factors projects are designed to establish ways to improve the effectiveness of human performance in the operation of the aviation system and to seek better methods for preventing human error, accidents, and incidents.
>
> **Atmospheric Environment** -- These projects will continue to improve current and forecast information on the environment in which aircraft fly, especially for severe and other adverse weather, winds aloft, visibility, windshear and turbulence, and wake-vortex impacts.
>
> **Communications, Navigation, and Surveillance** -- These projects will develop and exploit high-quality services and make them available anywhere on the surface of the earth, using satellite and data-link technologies when they are cost-effective.
>
> **Airport Improvement** -- Projects in this area will improve the safety of airports and increase the cost-effectiveness of major federal investments in airport improvements.

We applaud and support the FAA Administrator's recently-announced "A Vision of the Future: The ATC System Beyond the NAS Plan." This is a valuable blueprint for the future that reflects the views not only of FAA, but of a broad sweep of industry thinking in the U.S. and of governments around the world. It deserves to be the basis of FAA R,E&D efforts for the future.

These guiding elements of FAA development activities properly reflect what we see as a three-fold FAA mission :

- to conduct research, engineering and development to improve and refine the aviation technical infrastructure of aircraft operations and air traffic control, and the tools which support it;
- to conduct and sponsor research on aircraft and airman safety, with special emphasis on aging aircraft; and third,
- to look beyond, at the evolution of the aviation system for the future and to undertake the prodigious research and development effort to bring that future into being to serve mankind.

To accomplish what must be done, we believe a funding level of $260 million per year for fiscal years 1991 to 1995 is appropriate and needed. If the efforts by FAA to create a vital and vibrant research engineering and development organization succeed with the help of Congress and the aviation community, this amount is well justified.

To lay the basis for what follows, I'd like to discuss some essential background. R,E&D funding, if defined in the usual FAA budget line item terminology, has fared quite well in the last few years, rising to nearly $200 million for one year, and is still at a quite substantial level (the FAA FY 1991 request is for $190 million).

The problem was that for a number of years this money did not go into research or development. In the wake of the NAS Plan announcement in 1982, the money was allocated to the necessary and expensive engineering design work for the NAS Plan elements; -- important, but not R&D in the valid definition of seeking and exploiting innovation to improve the FAA system.

Real R&D practically disappeared. Worse, the organizational will and entity to carry out real R&D withered because, in a shrinking FAA work force, people were needed to carry out the NAS Plan work and little else. While comprehensive R&D plans were published for several years in a row, the actual result-oriented work failed to match the plans.

Progress in FAA R&D Organization

In the hearings on the 1990 FAA R,E&D budget, several witnesses reported positive signs of hope for progress. This year, while the effort is still in its infancy and the rate of recovery has been slow, there is important organizational progress:

- The new FAA "realignment" appears to show management is serious about re-establishment of a meaningful development capability in FAA after the significant decline during the NAS Plan years.
- Establishment of a sensible, perhaps definable, division between System Engineering and Programs and NAS Development and a little simplification in the maze of too-many organizational boxes is promising.
- Putting essentially all technical development activity into one organization is important.
- Recognition of the need for a System Design Group made up of knowledgeable and competent people to integrate the essential efforts and search for realistic innovation is a major step.
- The decision to establish peer groups of experts to advise FAA on the several major thrusts of its R,E&D effort is constructive.

We hope the FAA "realignment" represents both a dedication to improving the R&D process in FAA, and an organizational arrangement which can work. There remains a crucial personnel problem: the present FAA leadership has recognized, as we have, that the attempts under previous administrations to substitute large numbers of outside contractors for qualified FAA people has left FAA without adequate technical resources to manage even the best of those contractors. There is a growing recognition that there is an absolute requirement for a small but highly-qualified and capable corps of technologists who are FAA insiders.

The FAA "realignment" mentions the need for increasing the technical strength of FAA. The Administrator apparently has some new flexibility in moving people internally. There is potential for hiring some high-skill outsiders for short periods, but the major problem still needs to be solved. The long-term deterioration of FAA's capabilities has decreased the pool of competent technical staff to a small number. This problem is not unique to FAA but must be attacked as a serious problem facing aviation.

Progress in Substance

There has been progress in substance as well. In addition to the publication of the FAA administrator's "Vision of the Future: The ATC System Beyond the NAS Plan" and the establishment of the above-named major thrusts for its program, FAA's top management has recognized and indicated its intention that, while some R&D efforts are exploratory and relatively long-term, most of FAA's work is development and thus can be arranged to yield near-term valuable products that fit into the systems being implemented under the NAS Plan. There appears furthermore to be a willingness and a clear intention to tackle some of the major challenges long left untouched, as follows.

New Technologies Need Application Soon: Elements of the Future System Can In Some Cases "Leapfrog" over Old Problems.

A part of the FAA Administrator's Vision of the Future ATC System can lead, in our view, through evolution of the current system and the enhancements under development to best use of the technologies that are now mature but not yet implemented, and then to the emerging technologies.

The use of certain capabilities frequently considered for the more distant future, but actually possible much sooner, can create highly valuable improvements in air traffic control system capability. These techniques would not negate current modernization efforts but would enhance them. Airports capacity as well as airspace system capacity and efficiency could be enhanced.

Examples for early consideration of the FAA System Design Group:

Flight Management

The growing ability of aircraft operators to decide on optimum flight paths and to execute them accurately (and with knowledge in the cockpit provided by TCAS of traffic advisories on nearby aircraft) will inevitably push ATC into greater flexibility. Ability to accurately plan and follow flight plans and communicate automatically with the controller and his tools, will make ground automation essential. It will permit ATC to be conducted using enroute and terminal automation systems - (AERA and TATCA), with flow management as an overlay capability when needed.

Flow Management

Air traffic flow management and control must be conducted over the largest possible geographic area, under strong central management, and must be conducted in near real-time if it is to be effective. A basic philosophical determination will be needed on the relative emphasis to be placed -- in future development -- on flow control, essentially a "wholesale" way to manage air traffic, and the more fine-grained "retail" management which the AERA and TATCA automation developments will make possible to the benefit of individual aircraft.

Airspace issues related to air traffic flow management and control are crucial to the efficient use of both airspace and airports, and consideration of the two elements separately is likely to be less productive.

Enroute and Near-the-Airport Automation

Experts seem to be in agreement that the automation tools that are likely to work and be useful are those that offer advice and assistance to controllers: those which the controller can evaluate and accept or reject. Efforts that have attempted to automate processes in ways that leave the controller "out of the loop" have not been successful.

Enroute, transition and terminal ATC automation, flow control/automatic traffic management systems, oceanic automation, and airport surface automation must grow together into an integrated capability, and the integration concepts must be established now. Because of the difficulties of sustaining a large and unified effort, various automation efforts have proceeded independently in the hope that something would result, but the pace of progress to date has been very slow. While it may be appropriate to carry developments forward on several tracks, it is essential that an integrated system concept be established now. Tight integration is essential and must now be pursued vigorously.

A Major Effort to Improve Aviation Weather Data

Weather data, both near terminals and aloft, needs to improve dramatically. The safety-related parts -- wind shear, wake vortices, downburst protection, etc., must come first, but effective terminal and enroute automation and sensible flow management all require the best possible weather and wind gradient data.

There is a need to complete the development of "look-ahead" windshear detection capability which will accurately warn the flight crew in time to avoid penetration of the more hazardous windshear geometries.

Weather-related accidents remain the most important cause of general aviation fatalities, and improving the situation requires not only the development of techniques to develop timely and readily usable weather information, but perhaps even more important, the development of inexpensive dissemination and communication means so as to permit the bulk of general aviation pilots to acquire and use the information. We think that this matter deserves a completely fresh exploration of the possibilities. Such an exploration should include a review of those state weather services plans that address weather collection and dissemination systems.

Expert Systems and Communications/Computer Technology

Exploration of intelligent expert systems and of the newest computer and communications technology innovations should be pursued as elements of the human factors program in order to enhance the safety and efficiency of the overall system.

A New Study of Flexible Routing

While a good deal of the FAA effort is directed toward greater flexibility of aircraft operations, there is great value to all of aviation in an air traffic separation assurance function which permits full freedom of route selection limited only by the need to avoid conflicts and assure smooth, non-constricted flow. The importance of a continued search for such flexibility deserves the attention of the FAA system design group and special study funding.

Aircraft Safety

For FY 1991, FAA proposes $31.5 million, including efforts devoted to continued airworthiness of aircraft in service past their economic design life. We believe that number should be raised, to strengthen the substantial efforts under way concerning all aspects of safe flight, from fire prevention to bird strikes. Further research is needed on aging aircraft, particularly on areas such as human factors and on non-destructive inspection and non-destructive testing processes.

HR 3555 authorizes $10,000,000 to fund an FAA program that would enable the FAA to enter into research grants with universities and industry to establish research centers intended to develop technologies and methods to assess risk of defects, failures and malfunctions related to flight critical parts and processes. This program is not included in the FAA budget request, but it needs to be and is reflected in the figures proposed at the end of this presentation.

Human Factors

Significant increases are needed in work on human factors and aviation medicine. We believe no single area has greater potential for "return-on-investment" in terms of improved safety than wise, well-focussed research in this area. Efforts should focus on the interaction between the humans in the system (pilots, controllers, mechanics and technicians) with the machines they operate and among these humans, along with development of means to enhance overall system performance. A broad approach to this objective is presented in the National Plan to Enhance Aviation Safety Through Human Factors Improvements, which was developed by a broad cross section of government and industry participants.

Satellites

To follow through on the Administrator's Vision of the Future System, FAA should also pursue satellite systems more aggressively. They should accelerate efforts to bring the Global Navigation Satellite System to reality as a fully autonomous "sole-means" navigation system, to serve the U.S. and the world both enroute and at every airport runway end with autonomous, high integrity, rapid failure-warning, high-accuracy navigation. The potential benefits of satellite technology with respect to added safety and increased system capacity are enormous. Work is needed to establish the capabilities and benefits of satellite-based surveillance and communications over land areas, working hand-in-hand with terrestrial systems without burdensome additional avionics requirements.

General Recommendations

There is much to do: The detailed FAA R,E&D planning documents have not caught up with the promising plans. The much-criticized R,E&D plans documents have not yet caught up with the declaration of intent to encompass the ideas above. The newest FAA R,E&D management team has just begun the task of creating meaningful, supportable project descriptions. In a number of cases the actual efforts under way and getting under way are far better in reality than they are in the program descriptions. In what follows we base our recommendations on the assumption that the hard work to bring the actual R,E&D program in line with the statement of intentions will succeed -- and soon.

To come now to our general recommendations:

1. We believe it is appropriate for this subcommittee to recognize the positive steps that have been taken to improve FAA R,E&D organizational arrangements.

2. We believe it is appropriate for this Subcommittee to hold FAA management to its stated intention to concentrate on near-term milestones/output from R,E&D efforts and to its work to create a process by which innovations and R&D products can flow into the operating system without the hurdles and years-long delays that have plagued the process for years.

3. We recommend that FAA be asked to provide, as it would no doubt wish to do, reports of its progress on the recommendations of the Administrator's R,E&D Advisory Committee with respect to the major R&D thrusts and the development of projects that clearly and directly respond to those thrusts, as well as to assure that the funds and efforts identified are actually applied to the identified projects.

4. We recommend and endorse the establishment of a potent "system design group" to assure integration of FAA's efforts and adequate attention to

innovation, and the establishment of outside expert peer review groups to support FAA's efforts.

5. In FAA's work to restructure its programs and projects, we recommend that, rather than starting from scratch, the following material be used as appropriate:

   - The original 1982 NAS Plan, as it relates to automation and flow management, adapted to include the latest thinking on expert systems. It should be clear on the point that automation must begin with help to human beings and not serve to take-over functions human beings do well.

   - The recommendations of the Industry Task Force on Airport Capacity Improvement and Delay Reduction. (See Attachment 1)

   - The National Plan to Enhance Aviation Safety through Human Factors Improvement, which was developed by the Air Transport Association working with ALPA, APA, FAA, NASA, NTSB, TSC, Boeing and Douglas.

   - The Administrator's "Vision of the Future" and the recommendations of the ICAO Future Air Navigation Systems Committee (FANS) and of RTCA Special Committee 155, which offer a practical blueprint for development and evolution, especially for communications, navigation and surveillance (CNS) systems, and for terminal flow management.

   - The R&D recommendations on Security developed by airport experts working through AOCI. (See Attachment 2)

   - The recommendations on airport-related R&D developed by the AOCI and supported by the Industry Task Force on Airport Capacity Improvement and Delay Reduction. (See Attachment 3)

In suggesting these specific areas of work, the groups which have joined to present this testimony want to make clear that while we support the statements and the proposed funding, not all of the groups are expert in all of the FAA programs. Neither are all the constituencies equally affected by all of the proposals. It is agreed however that a viable, balanced and well-funded FAA R,E&D program benefits all of aviation, even if not all the efforts will have a direct impact on all segments of aviation .

RECOMMENDATIONS ON FUNDING

DOT/FAA has requested R,E&D funding authorization for the next five years at $190 million for FY 1991, and $195 million for each of the following four years.

The industry view is that the funding authorization should be at the level of $260 million for R,E&D, given the challenges that face FAA and the aviation industry. We make this recommendation under the assumptions, stated above, that the FAA's good intentions will be realized.

The introduction of effective air traffic control automation, the exploitation of airport and system capacity technologies, the transition to the new technology systems now becoming available, and the transition to a more flexible and cooperative air traffic control process will demand an intensive and well-funded effort.

The growing recognition that R,E&D does not end with demonstration of feasibility, but includes everything necessary to implement new concepts and systems justifies the increased funding.

While the majority of FAA's efforts are development rather than research, a percentage of the FAA effort, perhaps 15%, should be earmarked specifically for innovative, long term, exploratory research and analysis into issues of safety, air traffic control enhancement, and human factors.

FY 1991 R,E&D Funding Needs

For FY 1991 as well as the four years beyond, we believe that the amount requested by FAA, $190 million, is not sufficient to carry out the necessary work with the urgency or intensity it needs.

As discussed in Attachment 1, there is a need for continued emphasis on development and application of airport/system capacity technology. A funding level of $35 million annually (not including the airport-related R&D item just below) for activities supporting safe, full time increases in airport/system capacity is considered appropriate. We believe approximately $20 million of the FAA's proposed $31.7 million meets the House definition of full-time capacity enhancers, leaving a shortfall of	$15.0 Million
The need for continued improvement in airport surface/pavement, in which there is a major federal investment, requires sustained and output-oriented R,E&D effort. A minimum level of $5 million annually is considered appropriate. We think approximately $2 million in FAA's proposal is directly applicable to this item, leaving a shortfall of	$3.0 Million
For Security R&D, as discussed in Attachment 2, the amount needed is $42.7 million. The estimated shortfall is	$17.6 Million

For Human Factors work, as described above, the amount needed is $21.5 million, leaving a shortfall of	$5.2 Million
For aircraft technology work as described above, the amount needed is $54.5 million, including the presently unfunded university research grants program at $10 million, leaving a shortfall of	$23.0 Million
For weather related-research and development as discussed above, we believe a level of $12 million is reasonable, leaving a shortfall vs. FAA's proposal of	$3.3 Million
There is need to expand FAA's noise research program to develop a methodology to quantify the impact on operational capacity and air commerce of airport noise restrictions, to reexamine currently used noise metrics and to further progress development of aircraft noise abatement technology. Other environmental issues needing additional effort include those relating to Clean Air Act amendments being considered by Congress: engine emissions for both subsonic and supersonic aircraft, use of volatile organic compounds in manufacturing and maintenance operations and development of environmentally acceptable paints and coatings. FAA's request for $2.4 million should be increased to $4.4 million, leaving a shortfall of	$2.0 Million
For the special studies/projects identified above on expert systems and computer technology, satellites, and flexible routing, an additional $2 million each is need, leaving a shortfall of	$6.0 Million
Additional Funds Needed Total	$75.1 Million

Authorization of the FAA's R,E&D program at the $260 million level identified by the aviation associations as the appropriate level of effort would enable virtually all of the above work to be undertaken. We urge you to give serious consideration to our proposal.

Thank you, Mr. Chairman. The industry association representatives are prepared to answer any questions you and your colleagues may have.

Attachment 1

Requirements for Airport Capacity Technology Work

In selecting the elements of needed effort the Industry Task Force on Airport Capacity Improvement and Delay Reduction chose to concentrate on tasks which show promise of yielding increases in the direct, intrinsic, maximum achievable capacity of an airport complex. (This selection casts no negative reflection on other necessary FAA R&D work, but identifies the tasks which are considered to have the highest payback in terms of direct, full-time airport/terminal area capacity).

The specific recommendations of the industry, developed by the Industry Task Force, have emphasized tools and procedures for the reduction in lateral or longitudinal spacing requirements, tools to permit the reduction in required wake vortex spacing, the ability to provide independent arrival or departure streams, and the ability through automation to reduce inter-arrival variability. These projects will provide direct capacity increases essentially full time, right at the cutting edge where the requirements are.

We urge that Congress appropriate funds (and earmark them specifically for airport capacity technology by the definition given above) as follows for FY 1991 for the most essential capacity technology work:

Completion of Development, Installation, Demonstration, Procedure Development and Validation of High Data Rate and Medium Data Rate Sensor Systems for Closely Spaced Parallel and Converging Runway Reduced Minimums Operations	$6.0 Million
Airspace Procedure Development, Simulation, Validation and Demonstrations for Triple/Quadruple Runway Simultaneous Operations, Reduced Minimums Converging Operations, Wet-Runway Reduced Minimums Operations, Establishment of Criteria and Specific Achievable Minimums Benefits from MLS or FMS/ILS Precision Curved/Segmented Approaches and Departures	$4.0 Million
Airspace Procedure Development, Simulation, and Validation of Terminal Automation Tools, to achieve earliest possible stage-by-stage implementation of applications of "ghosting" (mirror imaging) applications, descent advisory, time-to-turn-to-final and final approach spacing advisory systems, and a terminal operations planner	$8.0 Million

Reduction of the Capacity Reducing Impact of Wake Vortices, through development of automatic dynamic spacing adaptation, development and validation of wake vortex detection and avoidance sensors and renewed efforts at elimination of wake vortices at the aircraft source.	$4.0 Million
Simulation Model Development and Validation	$2.0 Million
Development and Validation of Minimum Performance Standards and Procedures for safe use of cockpit traffic displays in terminal operations	$0.4 Million
Airport Surface Visual Control (Lighting) to permit efficient taxiway exit operations, development, validation and procedure development for stop bars and hold-short systems for runway entrances and ends	$1.2 Million
Airport Surface Traffic Automation, utilizing earlier research and development to develop and demonstrate an airport surface surveillance, guidance and control system, implementable in steps and using the technologies used in the airspace system where practical.	$4.0 Million
Airport Capacity Enhancement Planning and Analysis	$1.5 Million
Total	**$31.1 Million**

This amount is the minimum need for a concerted attack on the capacity problem. Little if any of this is research; virtually all is development. In addition, approximately **$5 million** of additional FAA Operations funding (or alternatively, R,E&D) is required to conduct planning and development analyses to assure optimal operation of the FAA system, by funding application of appropriate airport and system analytical tools, and supporting airport-specific task forces.

A minimum of approximately **$5 million** of additional R&D funding is necessary to conduct meaningful airport-related R&D, to enhance safety and to provide for product improvement on FAA's major investment in runways and pavements. (A proposal for well-focussed priority FAA R&D in this field has been supported by the Industry Task Force on Airport Capacity Improvement and Delay Reduction. (Attachment 3)

Virtually all the recommendations contained in this material deal with ideas and concepts which are well understood and which require energetic development and implementation. We believe a small amount of money should be devoted to the development of new ideas and new concepts by advanced thinkers in the field, and propose that Congress earmark **$0.5 million** for this purpose.

F&E funds will be required to achieve the gains promised by the R&D projects. Most of such funds have not yet been requested, but the above needs assume that FAA's request for F&E or AIP funding for a minimum of eight precision runway monitors will be favorably considered by Congress.

Congress will need to help FAA arrange to purchase and implement these PRM systems without procurement delays which could prevent use of these essential new systems until 1996-1997.

In summary, we believe that for FY 1991 a minimum total of $36.6 is needed for airport capacity technology work. If Operations funding for operations analysis work can not be found, a total R,E&D amount of $41.6 million capacity funding will be needed.

Attachment 2

1991 R&D Funding Needs for Aviation Security Recommendations

The FY 1991 Congressional submission of $26,362,000 for R&D in aviation security equipment and procedures, while a slight improvement over last year, still remains inadequate.

There are four major areas of aviation security which require concentrated R&D efforts: (a) explosives detection, with 1991 funding indicated at $22,615,000; (b) weapons detection, $1,899,000; (c) airport security, $1,249,000, and (d) systems integration, $599,000.

(a) **Explosives detection:** Most of what has been written about the FAA effort to develop thermal neutron analysis (TNA) explosives detection systems has pointed out their operational difficulties and physical limitations. The National Academy of Sciences report to FAA, due out shortly, not only will suggest that the operational realities of an airport environment requires that to be fully effective TNA should be mixed with several levels of complementary technology, but it will also note that practical applications of such new technology as vapor sensors, millimeter wave inspection, gamma ray absorption, and biotechnology may be no sooner than three-to-five years in coming.

Therefore, if we are truly serious about enhancing our short term ability to detect explosives, **the $22.615 million R&D budget item should be augmented by $5 million** (22%) **for a concentrated effort toward accelerated prototyping and testing.**

(b) **Weapons detection:** Several alternative hardware and software technologies are in the developmental stages, including magnetic resonance, new metal detectors, new x-ray techniques, and pattern recognition software. It is not reasonable to accelerate detection of the explosives threat while leaving an equally critical weapons threat unimpeded. In order to bring new weapons detection solutions on-line as rapidly as possible, **we recommend the $1.899 million budget item be increased by $285,000 (15%).**

(c) **Airport security:** While FAA has made a laudable beginning with the demonstration program being conducted by Sandia National Laboratories at BWI Airport, it is still only a beginning. The BWI program will test several combinations of technologies, methods and procedures applicable to that airport, under their operational strictures and conditions.

While there will certainly be broader lessons to be learned from this experience, there remains in place what amounts to a federally-mandated trial-and-error security R&D program at 270 other airports: the rule requiring airports to install access control systems within 18 months.

Last year, AOCI recommended, and indeed, the FY 1990 DOT Appropriations Bill's report language directed that the FAA conduct operational testing of access control systems at four airports of varying size and complexity.

That directive from Congress was never undertaken.

One possible reason is lack of funding, which we suggest may still not be too late. Although some major airports have begun to implement their amended security plans, the constantly changing interpretations, explanations and clarifications of the requirements emanating from FAA are causing airports to revise their plans even as they are being installed. This underscores the point that the original requirement was poorly executed, and a significant amount of R&D remains necessary to implement a nationwide system of airport security which makes sense.

We therefore recommend that Congress provide R & D funds in the amount of **$12 million to allow FAA to implement the mandated four-airport, 18-month pilot program** to identify, install and test airport security technology and procedures in an operational airport environment.

(d) **Systems Integration:** None of the above makes any sense until each is coordinated with all the others, as well as with additional concepts in both hardware and methodologies designed to strengthen the overall security system. This includes working with enhanced threat assessment procedures, as well as R&D into methods to contain explosions inside aircraft.

This process is necessary to be certain that while one threat is identified and contained, our attention is not diverted from another door being opened by the terrorist. In an effort to **expedite such integration, we recommend raising the request by $300,000 (50%)**.

Attachment 3

AIRPORT OPERATORS COUNCIL INTERNATIONAL

August 18, 1989

Priority Projects for Airport-Related Research and Development

The airport community has long advocated a solid research and development effort which, said most simply, provides for a modest but consistent effort of product improvement for the very large investment on airport runways and pavements. When one considers that over the past several years in the U.S. alone, the taxpayers' investment in the Airport Improvement Program has been in the range of $1.25 to $1.50 billion per year, and perhaps 60 and 65% of that for airport pavement, a rational result-oriented product improvement R&D effort seems a wise investment.

For some months the AOCI Technical Committee worked to try to understand the needs and to formulate a set of recommendations for a tightly structured and result-oriented R&D effort of manageable scope. The AOCI Board of Directors has concurred in these recommendations. The Industry Task Force on Airport Capacity Enhancement and Delay Reduction has endorsed these recommendations and has urged FAA work in the U.S. at a minimum level of approximately $4 million/year in contract funds on these concerns. AOCI hopes that other administrations and their research institutions will also undertake this kind of work.

Airport operators have examined current and proposed R&D activities in this field, and have considered their own perceptions of problems encountered at their airports. We believe the following activities deserve particular attention:

1. Development and Agreement on a Universal Pavement Design in Conjunction with ICAO and Other States

Development, field validation and standardization of methodology for design, evaluation and testing of airport pavements in both moderate and extreme climatic conditions with consideration for aircraft traffic volume and mix.

- Standard thickness criteria for new pavements, rigid and flexible
- Unified design approach to slab layout
- Unified design approach to load transfer mechanisms at transverse and longitudinal joints

Standard overlay thickness characteristics for defined load an serviceability criteria, for various base pavement designs and conditions

Consistent and validated design calculations and methods for asphaltic overlays on rigid pavement; layered elastic analysis methods, valid accounting methods in designs for various base layer constructions.

Develop synthetic materials suitable for use as aeronautical pavement in order to reduce costs through improved performance, over an extended life, with minimized maintenance.

Develop standards for vertiport pavement to accommodate increased heat/blast for vectored-thrust VTOL aircraft.

Standard methodology for assessing impact of large and heavy-footprint aircraft on existing pavements, and on new pavements - a long-term item.

and , perhaps less urgently:

Standards for acceptable materials for cold weather protection and for overrun areas.

Standard acceptance criteria for inspection of materials and design/construction.

It will be necessary to develop a realistic coordinated effort involving a number of concerned agencies and airports on this project, and to assure recognition that extended monitoring and life testing will be required of typical designs. Retroactive examination of existing pavements to establish the relationship between design/construction and useful life will be needed. It will further be necessary, in order for large-scale field testing to be useful, to grant waivers from normal practice.

2. A Universal Non-Destructive Testing Methodology

Development, validation and standardization of a non-destructive test method to assist in rating pavement bearing capacity for aircraft, and prediction of pavement life.

Develop a data collection system to non-destructively monitor pavement strength/lifecycle without disrupting airport operations.

3. Runway Friction Measurement Criteria and Relation to Aircraft Stopping Distance

The long-standing need for a validated method for establishing required operational stopping distance for different aircraft types and wheel/tire characteristics, over the range of acceptable piloting techniques, vs. runway friction characteristics, remains a valid objective and should be actively pursued.

Definitive work should continue to develop criteria and standards for acceptable friction measuring devices, with the aim of achieving uniform world-wide agreement on measuring scales and their meaning.

4. Runway Rubber Removal and Friction Retention Methods

Research organizations should direct or undertake intensive, high-priority research into runway rubber removal methods. Of particular importance are the following elements:

The efficacy of various rubber removal methods for removing rubber (such as water at various intensities, chemicals, etc.)

The quantitative effect of the various rubber removal methods on different types of pavement.

Impact of climate or other regional conditions on rubber accumulation and removal, as well as pavement treatments or designs which avoid or retard rubber build-up.

Propensity of different rubber removal methods to polish the pavement or, conversely to improve friction characteristics.

Impact of different cleaning methods on runway grooves and groove performance.

Establishment of environmental impact, if any, of various rubber removal methods and the development of techniques for eliminating adverse effects.

Development of methods to speed up rubber removal.

Develop specifications and standards of effectiveness for de-ice, anti-ice, and snow control chemical agents.

Establish criteria to permit use of aircraft arrestor devices in lieu of runway overruns.

- Convincing, statistically significant data on these conditions should be used to develop criteria for future standards.

5. Continued Directed R&D and Validation Testing for Improved Joint and Fixture Sealants and Other Maintenance Techniques

. Work to Increase World-Wide Standardization of Airport Airside Signage, Marking and Lighting with Special Emphasis on Incursion Prevention

7. Development of Standards and Criteria for Runway/Taxiway Surface Roughness

Standards are needed for surface roughness which take into account the dynamic behavior of the most critical aircraft expected to use the runway.

Maximum acceptable g-value design criteria need to be agreed for

- new or renovated runway designs
- maintenance planning
- operationally safe roughness limits requiring immediate action.

Mr. TORRICELLI. Thank you, Mr. Gormley.

Mr. Brown, did you have a statement you wanted to deliver at this time?

Mr. BROWN. Yes, Mr. Chairman, and I'd like to summarize it as well.

STATEMENT OF STEVEN J. BROWN, VICE PRESIDENT, STRATEGIC PLANNING AND POLICY, AIRCRAFT OWNERS AND PILOTS ASSOCIATION

Mr. BROWN. I appreciate the opportunity to appear before the subcommittee this afternoon and represent the interests of the Aircraft Owners and Pilots Association. We are the largest civil aircraft association in the world and our over 300,000 members fly general aviation aircraft primarily for business and personal transportation. As such, we represent 98 percent of the pilots who operate those registered aircraft in the United States, and understandably then, are the key beneficiaries of well-focused research and development programs.

As an overview, Mr. Chairman, we feel—much as you said in your opening statement—that much of FAA's proposed R&D budget over the period that they offered a proposal is skewed and has no real long term vision. There is an overemphasis on engineering and development and not an emphasis on research, especially long-term research.

Clearly there needs to be more done in the area of medium to long term research that has a pragmatic benefit for the users as well as for the government.

In addition, as Mr. Gormley mentioned earlier, we also feel that too often in the past, the R&D programs have become essentially a flexible spending account for F&E programs and have not truly been research programs. We'd like to make sure that in the future, there is a focus on the long-term and innovative research that needs to be done.

Secondly, we feel that the Administration's proposed funding level is far too low. In fact, we believe that over a 5-year period, through the leadership of this committee, we'd like to see it build to about $300 million. We believe that is a pragmatic level and will offer details on that in a few moments.

We believe this is important primarily to preserve American leadership and competitiveness in the areas of innovation in aviation, and also to develop future navigation programs for international as well as domestic U.S. aviation.

Mr. Chairman, there are some optimistic signs on the horizon. The FAA reorganization that occurred recently we believe will help accomplish some of the long term research that has been lacking in the past. We also believe that the Research and Development Advisory Committee that was initiated by Congress and has been functioning over the last year has had a very beneficial impact on FAA.

In addition, lately, Admiral Busey has been quoted as saying that "The future system will be a truly international system and one whose benefits may come sooner than many have anticipated." Also, our colleagues on the airline side of the house, the Air Transport Association, have noted that the airlines agree that a future satellite-based system must, in fact, be aviation's ultimate goal.

We feel that clearly in the area of navigation, the priority for this committee and for the aviation industry should be the development of a future system that includes satellite capabilities as well as some current ground base capabilities.

Mr. Chairman, our members, who operate in the national air space system have continually upgraded their aircraft to meet current technology needs and to respond to future technology. In fact, now 50 percent of our fleet is equipped for instrument flight and in 1977, only 30 percent of it was. In fact, some 30 percent of our fleet now has LORAN-C capability—which is a navigational capability—and this has only been available in the marketplace since 1984.

Mr. **Torricelli**. What percentage was that, Mr. Brown?

Mr. **Brown**. Thirty percent, and that's nearly 205,000 aircraft, so it's a significant investment on our part. As you may know, general aviation is one of the more cost sensitive elements in our system. So they are eager to invest in new technology and we believe that satellite navigation, communication and surveillance is the next wave of technology as others in the industry. We are anxious to invest in it.

Clearly, the advantage of this new navigation capability, in essence, will be greater efficiency and cost savings for our users as well as for the government. There is a good reason to make an investment there.

Fortunately, the military, or the DOD, in this case, has launched half of the satellites that are required to support this navigation system and their current launch schedule will have all of those in place by 1992. Clearly, it is something that is achievable in the near term, in our view, and we believe that it is possible to have, for domestic U.S. use, a system in the en route air space by the mid-1990s with possible application in the terminal air space by the turn of the century.

We believe also that the benefits will come along not only in navigation but also in future communications capabilities through the use of datalink and also in terms of surveillance. The bottom line benefit of satellites being that there will be a replacement of many of the cost-based and very expensive systems that we have that are ground-based now that can be replaced once we have future satellite systems in place. Clearly there can be some economies in future F&E expenditures if we make the investment today in appropriate long-term research to provide these services in the future.

Clearly the size of the Federal budget is a concern and clearly FAA needs to economize to deploy those programs of highest priority.

The international community has estimated that a satellite system providing these services will offer, on a worldwide basis, $5 to $6 billion a year worth of benefits to the users and to governments, and in fact, it will cost about $1 billion to operate. There is clearly a very favorable cost benefit ratio.

Also, Mr. Chairman, a secondary priority for us in general aviation are weather programs. This is an area of the FAA RE&D

effort that is one of the smaller components of their program comprising only a few percent.

Unfortunately, FAA has decreased this year the amount they are proposing to put into the weather program and it's primarily because of the view that they've invented the black boxes, the sensors, and the radars that were referred to in opening comments. They have overlooked the fact that they need to take the product of these new sensors and put it into a usable product, customer service that can be used by pilots.

They need to put effort and research into developing these products. In fact, it won't take that much money. As is noted in our testimony and it is explained there, we believe these services and products that pilots can use to improve aviation safety can be developed for only about 5 percent of the capital expenditure that both the National Weather Service and FAA will make and is currently involved in their NAS Plan.

It is on the order of $200 million and we believe that over a period of 5 to 10 years, that's a reasonable investment to make and can be accommodated in the funding levels that we are discussing.

Weather is a priority to us because in general aviation we fly in the weather because we tend to operate in the lower altitude structure of the national air space system. The airlines clearly, on climb and arrival, operate in the weather as well, but for the most part, they are above the weather when they are flying en route. Unfortunately, we don't have that capability. We live and fly in the weather, so good weather information is very important to us, not only from an efficiency and operational perspective, but also from a safety standpoint.

We'd like to see that 5 percent investment made and we believe that the current component of general aviation accidents that's weather-related, that is 25 percent that is nonfatal and 40 percent of the fatal accidents in general aviation are weather-related, and could be materially reduced if we had better weather products. We believe we should have them since we've made that $4 billion investment in enhanced sensors.

Also, it should be noted that the weather is 60 percent approximately of all the delays that we encounter in the system on the part of all users. We believe those better weather forecasts products would certainly increase capacity and reduce delays in the aviation system.

Lastly, Mr. Chairman, we believe FAA has proposed underfunding of the medical and human factor-related portions of the RE&D program. In years past, in the early years of aviation, airworthiness or mechanical-related problems were a very high percentage of the safety problems that we had. Today, it is not the case. The manufacturers and others are to be commended for in fact improving on that record.

Now the major obstacle that we face in aviation safety is learning more about human performance and decreasing the error rate on the part of the humans that run the system, whether they are pilots or air traffic controllers, or mechanics. These human errors are, in fact, the largest component we have to overcome.

This is not an area that FAA is particularly comfortable with. FAA has, in its research programs, many people who are familiar with and capable of inventing black boxes but they are not staffed well, nor do they rely well on people who are skilled in what we call the soft sciences. These are areas that are human performance-based and the medical field as well.

It is an area that FAA has not really stepped up to the plate and provided a leadership role to provide the next quantum leap in safety where they clearly should and need to in the future. We would ask you, through the leadership of this committee, to try and get FAA to step up to the plate and provide leadership in that area and stimulate some progress in the reduction of accidents that are due to human error.

Lastly, we have a couple of recommendations for the committee. Overall, we'd like to see, as I mentioned earlier, a focus on long-term research rather than near-term, short- term, ATC-related and development types of emphasis that FAA would prefer to have in their R&D program.

We believe that about 10 percent of today's RE&D budget is allocated to medium to long term programs that have benefits in that range and that over the period of the next 5 years, that should build to about 40 percent of the total program, and—as I mentioned earlier—we ought to build to a $300 million level.

We'd also like this committee to inquire of FAA how long they think it's going to take to develop the Aviation Weather Plan that they have started with NWS. We hope that it won't take more than a year.

We believe that it is time for those two agencies to get together to sort out their plan and to in fact come up with a consolidated effort on the part of both agencies, both having responsibilities in the aviation weather area, to get at generating the products that will have a tangible safety benefit.

Lastly, Mr. Chairman, we'd like the committee to work with FAA to increase the allocation of funds and program priority that goes to solving the human error problem in the system. We've done a good job, not a perfect job, in the area of airworthiness but we'd like to see some increased emphasis now since we have those achievements on the human factors.

Thank you.

[The prepared statement of Mr. Brown follows:]

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Statement of Steven J. Brown

Vice President
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Aircraft Owners and Pilots Association

Before the

House Committee on Science, Space and Technology
Subcommittee on Transportation, Aviation & Materials

Honorable Robert G. Torricelli, Chairman

Concerning Reauthorization of
FAA's Research, Engineering & Development Programs

April 24, 1990

Thank you, Mr. Chairman. I appreciate the opportunity to appear before the subcommittee. My name is Steven J. Brown, and I am Vice President for Strategic Planning and Policy for the Aircraft Owners and Pilots Association.

AOPA is the largest civil aviation organization in the world. We represent the interests of over 300,000 pilots and aircraft owners in the U.S. -- more than 50 percent of the nation's active pilots. AOPA members take advantage of general aviation aircraft to fulfill their personal and business transportation needs. General aviation is a true cross-section of the aviation community and, as operator of 98 percent of all registered civil aircraft, is a major beneficiary of safety improvements and well focused research programs.

In our view FAA's proposed RE&D program is overly biased toward "engineering and development" of short term ATC related items. Much more emphasis and funding should be placed on research that has a medium to long term benefit. FAA's RE&D efforts should not be a flexible spending account for the agency's favorite F&E programs.

FAA's RE&D proposal is also heavily biased toward "system efficiency" and does not sufficiently address the nation's pressing need for large-scale system capacity improvements. Other areas of the FAA budget are designed to address management of "todays problems" and clearly, the RE&D focus should be on capacity and safety for the future.

Mr. Chairman, these hearings on the reauthorization of the FAA's Research, Engineering, and Development budget come at a critical time for aviation. Technology has advanced to a point where initial implementation of a hybrid air traffic system linking satellites with a ground-based system, such as LORAN C, for communications, navigation and surveillance is feasible beginning in the mid-1990's. A hybrid space/earth system linking the Global Positioning System with ground-based, random-routing capability would provide much greater accuracy, reliability and integrity than the current system. It would also be significantly less costly to operate.

An aggressive push from Congress can help ensure that an operational transoceanic space/earth system can be in place by 1995. By the year 2000, we believe a fully operational system can be a reality for domestic use in the en route environment, with potential terminal implementation following thereafter.

We are encouraged by the FAA's clear acknowledgment that technologies such as LORAN C and the GPS satellite system are the wave of the future. I quote from an Advance Notice of

Proposed Rulemaking issued by the FAA and published in the January 22, 1990, Federal Register:

> "In the near future, other navigation systems may prove capable of providing the same function as VOR/DME. For example, Loran C and Global Positioning System (GPS), or a hybrid of the two systems, may prove to be equivalent to VOR/DME in navigation system capability."

The January 22 rulemaking announcement was issued by FAA to initiate the process of selecting a future air navigation system to replace the current system. In addition, Admiral Busey has recently noted that "the future system will be a truly international system; one whose benefits may come sooner than many have anticipated."

Likewise, we were pleased by the comments of our colleague, Robert Aaronson, President of the Air Transport Association, in his speech before the International Aviation Club on February 20. The subject of the speech was "Satellites: A Key to Making Aviation Work in the 21st Century." He noted that "the airlines agree that a satellite-based system must be aviation's ultimate goal."

In this era of tight fiscal constraints, AOPA believes that the only rational approach to aviation system modernization is program prioritization and more responsible resource management. We should resolve to apply resources only to those NAS Plan programs which are compatible with a hybrid space/earth system or which are necessary to ensure the safety and efficiency of the system during the transition. The remainder of our resources for F&E, as well as our technological focus, should be directed to developing the space/earth system of the future.

FAA RESEARCH, ENGINEERING, AND DEVELOPMENT

Our ability to accelerate the inevitable transition to a space/earth system hinges largely upon the proper levels of FAA RE&D funding. AOPA recommends increasing the authorized level over the next five years, ultimately reaching a level of $300 million per year for FAA RE&D.

For FY'91, the Administration has proposed an RE&D budget of $190 million -- an increase over previous years, but still well below the levels historically recommended by Congress. And the Administration's proposed reauthorization package calls for $190 million for FY'91 and $195 million per year for FY'92 through FY'95. Although this proposal represents an increase from previously appropriated levels, it still falls woefully short of the real research needs in aviation. Once again, we face a situation where American leadership and competitiveness in an important area will be lost because of a lack of long-term commitment on the part of the Administration.

Much higher funding levels will be necessary if we are to keep pace and take advantage of emerging technologies. The following comments outline our position on the major areas of RE&D priority - navigation and weather.

TRANSITIONING TO THE FUTURE

Our call for the aggressive development of a hybrid space and earth system is merely the latest in AOPA's tradition of seeking to advance the technical development of aviation. Historically, AOPA has taken the lead in advocating important safety initiatives and technological advancement. AOPA was the first civilian organization to urge the installation and mandatory use of shoulder harnesses in light airplanes. We emphasized the benefit of stall warning indicators, and even marketed and sold them to members, until ultimate adoption of these devices as standard equipment by general aviation manufacturers.

Over the years, AOPA has launched successful programs to improve the air-navigation marking system, to increase the availability of airport lighting, and create a new generation of community airports. Our organization first proposed the idea of marking runways according to their magnetic direction, an idea that became a worldwide standard.

AOPA members continually update their aircraft with state-of-the art technology as it becomes available. Just over 50 percent of the active general aviation aircraft in the country are fully instrument equipped, up from 30 percent in 1977. The percentage equipped with on-board weather radar has nearly doubled since 1977. More than 30 percent of the active fleet has been voluntarily equipped with LORAN C, which wasn't even available for aviation use until 1984. Satellite technology is the next phase, and our members are eager for the benefits.

The advantage of a hybrid space/earth system is that a large portion of the technology has been developed and tested, and nearly one-half of the satellites are in place. The U.S. government's Global Positioning System already has launched 14 satellites, which will provide three-dimensional position reporting. Based on the current launch schedule, all the GPS satellites are scheduled to be in orbit by the end of 1992.

The accuracy of this system for purposes of navigation will exceed that of today's ground-based VOR system. When combined with LORAN and other random routing technology, it promises the ultimate potential down the line of permitting precision instrument approaches to runways throughout the world without the need for future ground-based instrument equipment, such as the Microwave Landing System or conventional Instrument Landing Systems. Satellites clearly offer the long-term promise of replacing today's ground based navigation system and will provide more cost effective navigation services. However, in order to achieve the most efficiency, FAA must abandon its current plans to monitor satellite performance with a ground based system. The technology for a space based monitoring system is achievable.

At the same time the U.S. is employing its GPS satellite system, the USSR has embarked on development of its own satellite air navigation system called GLONASS. Additionally, INMARSAT, a London-based multinational consortium that provides communication and navigational services to the maritime industry, currently has satellites in orbit providing prototype aeronautical services. According to the Future Air Navigation System Committee (FANS) of the International Civil Aviation Organization, all 42 GPS and GLONASS satellites are scheduled to be in orbit by the end of 1992.

Once the U.S./GPS, USSR/GLONASS and INMARSAT cooperative agreements are implemented, global navigation will be possible. Indeed, the Department of Transportation conducted a study concluded in September of 1989 to determine if an integrated space/earth system would be feasible. The study used GPS and LORAN C, and the results were very encouraging. Not only did the hybrid system work, it exceeded all expectations.

The test also demonstrated that non-precision approach capability is immediately achievable at virtually every landing place in the United States. The test further indicated that Category I Instrument Landing System precision instrument approach minimums are well within the ultimate grasp of the technology.

In addition to navigation, greatly enhanced communications and surveillance capabilities will be possible through the use of satellites. Communications between aircraft and the ground will be accomplished through satellite relayed voice communications and also through the use of data link. The NAS plan Mode S data link is not the only way, nor is it necessarily the best way of providing data link services. Currently, ARINC provides reliable satellite data link services to airline users, and COMSAT plans to offer satellite data link. These or similar satellite services could obviate the need for expensive ground based Mode S data link technology.

Automatic Dependent Surveillance is the third piece of the future communication, navigation and surveillance package. ADS will use satellites to provide three-dimensional position reporting for the air traffic control system. The information will be transmitted through the data link, from the air to the ground directly or via satellite. The advantage of ADS is it will permit a highly reliable and accurate surveillance system without the need for investment in expensive ground-based radar equipment, either en route or ultimately in terminal areas.

The technological advantages of a hybrid space/earth system are exciting. But those are not the only advantages. The FANS committee of ICAO has estimated that the new global satellite system will cost only about $1 billion annually to operate worldwide and, on a global basis, would save governments and the industry approximately $5.2 to $6.6 billion annually.

In these times of increasingly scarce resources, the substantial short and long-term cost savings inherent in transitioning to such a system are too good to pass up. If we begin the transition process now, we can save billions on some of the existing NAS Plan programs which will be unnecessary or incompatible with the system of the future.

In light of the potential that the hybrid space/earth system brings us, the FAA's commitment is suprisingly weak. This year's funding request for navigation research represents a decrease over FY'90, when viewed in percentage terms of the overall budget. The Administration's priorities fail to reflect an understanding of the benefits to be derived from the next generation of technology. Strong encouragement from this Committee is essential to focus FAA's efforts in this regard.

WEATHER PROGRAMS

Mr. Chairman, there is nothing more important to a general aviation pilot than the timely detection and dissemination of hazardous weather information. General aviation pilots fly "in" the weather. The airlines, with the exception of the critical arrival and departure phase, of course, fly "above" the weather. To AOPA members, weather information is not just helpful, it is potentially life saving.

The National Transportation Safety Board reports that over the past five years, weather has been a factor in approximately 25 percent of all general aviation accidents and a factor in 40 percent of all fatal general aviation accidents. The aviation accident rate could be substantially improved if accurate forecast and timely weather information were more readily available for both preflight planning and in-flight decisions.

Looking beyond safety considerations, weather is also the single largest contributor to delays, comprising nearly 60 percent of all delays in the ATC system. The erosion of weather services for all aviation users and FAA's failure to develop and deploy on a timely basis the available new technologies is the most devastating deficiency in the implementation of the National Airspace System Plan.

Detection. As part of their respective modernization programs, the FAA and NWS have committed to a combined capital investment of $4 billion to improve weather detection capability. These initiatives include the development and deployment of such technologies as new radars and wind sensors, and they are expected to help address the needs of aviation by providing vastly improved information concerning dangerous weather.

However, NWS and FAA must be encouraged to continue improving their ability to disseminate weather information in usable "product" form to the aviation community. The enhanced ability to gather meteorological information must be matched by a corresponding ability to deliver that information. Otherwise, we cannot ensure system safety, nor realize improved capacity and efficiency. And the cost of developing improved aviation weather products will be a fraction of the capital investment in new detection equipment--perhaps as little as 5 percent.

From a general aviation perspective, our priorities for improved weather products include the ability to provide automated weather observations, heavy snow detection, accurate in-flight icing forecasts, and specific thunderstorm area forecasts. AOPA believes the development and implementation of these and other improved aviation weather products should be considered largely the responsibility of the FAA. In fact, many are currently in various stages of research and development.

Interagency Relationship. We feel there is a problem deeper than just funding. The FAA and the NWS have failed to work together to develop an integrated network of weather services. Historically, the FAA has tended to neglect the importance of aviation weather. With the expected appointment of a new FAA weather coordinator and the commitment of FAA and NWS to a national aviation weather plan, we see the beginnings of an important change. However, the current NWS philosophy remains, "We're not in the business of specialized aviation weather."

Given the weather modernization effort going on in both agencies, it is inconceivable that to date, these two agencies have not already come together to develop a plan for a single integrated network of aviation weather services.

OTHER PROGRAMS

The FAA's RE&D proposal essentially ignores the agency's responsibilities in the area of aviation medicine and the related area of human factors research.

In aviation's early years, most accidents had as a significant ingredient, mechanical or "airworthiness" related deficiencies. However to the manufacturer's credit, aircraft structural failure is no longer a primary cause of the majority of today's accidents. Rather, it is the "human performance" of operators which is the most predominant challenge facing us in improving aviation safety. FAA, has in our view, avoided addressing this reality since most of its technical expertise is invested in the hard science of "black boxes" and electronics. However, a casual review of today's accident cause/factors reveals that urgent advances are needed in the "soft sciences" which are human performance and medically based in order to achieve any significant future advances in aviation safety.

In our view, we have reached a point in air transportation that the invention of another "black box" to address a perceived safety problem may be counter productive and actually lead to "human overload." FAA should step up to the plate and take an aggressive leadership role in addressing human factor elements in contemporary accidents and devise research programs that promise to alleviate future accidents.

RECOMMENDATIONS

We offer several recommendations for your consideration. First, we urge this Committee to authorize a substantial funding increase for the FAA RE&D program to ensure that the research necessary to achieve accelerated transition to a hybrid space/earth system will be conducted. We recommend a progressive increase to an annual level of $300 million for FAA RE&D.

Second, AOPA recommends that Congress encourage FAA to take a more aggressive stance in planning the transition to the next generation of technology. Every endeavour begins with a single step, and we urge Congress to take the first step by directing FAA to develop and submit to Congress a plan for transitioning to a hybrid space/earth system.

Finally, with respect to weather initiatives, AOPA urges this Committee to closely monitor the relationship between FAA and NWS. It is time for FAA and NWS to agree upon a mission, and with input from users, work together to achieve common objectives that will enhance aviation safety.

We are encouraged that FAA and NWS have begun to develop an aviation weather plan, but we don't want this process to drag on indefinitely. AOPA urges the Science Committee, with its unique jurisdiction over FAA RE&D programs and the NWS, to mandate that the FAA/NWS aviation weather plan be developed in not more than a year.

* * * *

Mr. Chairman, I stress again that the future is at our doorstep. It is time to reevaluate our goals and take advantage of the next stage of technology. The question is not whether we will pursue this course, but when. We are counting on your leadership to help resolve that question by helping to place development and transition to a hybrid space/earth system on the fast track.

Thank you again for this opportunity, Mr. Chairman. I will be happy to respond to questions.

Mr. TORRICELLI. Thank you, Mr. Brown.

Are there other members of the panel who would like to make brief statements before we proceed to questioning? Mr. O'Brien?

STATEMENT OF JOHN O'BRIEN, DIRECTOR, ENGINEERING AND AIR SAFETY, AIR LINE PILOTS ASSOCIATION, INTERNATIONAL

Mr. O'BRIEN. Thank you, Mr. Chairman.

Just a very brief statement following up on what Steve mentioned there about human performance and what area we could concentrate on if we were going to attack the one large remaining safety problem that faces us today.

Steve is right, the FAA does not have the capability to address this problem adequately. They've made a good step in retaining the services of Clay Fouchee to try to define the program or get started attacking this problem, but the real talent to address this problem lies within NASA. The best way for FAA to address this problem is through interagency agreements with NASA to look at human factors and human performance.

This committee does have the ability to look into NASA R&D efforts and those of us who sit both on the NASA Aeronautics Advisory Committee and the FAA Research, Engineering and Development Advisory Committee have encouraged close cooperation between FAA and NASA to attack this particular problem.

There are other related problems that are best served by joint activities between NASA and FAA. For example, we have, as Steve pointed out, corrected the mechanical problems but we haven't corrected all the potential black box problems. I am getting into an area called software validation and certification. It is a big area of concern to pilots, especially facing high tech airplanes with high levels of automation and the FAA does not have a good handle, nor do the manufacturers have a good handle, on software validation and certification.

NASA does have the capability to look into this particular subject and I would encourage the committee to look both at NASA and at FAA for some leadership together in this particular area.

One last comment, the FAA R&D programs over the past several years have, as we have indicated, concentrated almost exclusively budgetwise and commitmentwise to air traffic control. There are a lot of other problems out there. Those problems have been addressed by FAA through individual projects, various projects within flight standards or the old aviation standard section looking at how low can we go, low visibility operations, other types of programs like that aren't called research and development, aren't funded through research and development funds, that are used on other funding sources. It is good work and it needs to be continued.

This is not a complaint. It is just a suggestion that the committee needs to look at all of the activity that's going on within FAA that should be characterized as R&D and maybe bring it under one focused effort. I think we'd get a lot more for our resources if we were to do that.

Mr. TORRICELLI. Thank you, Mr. O'Brien.

Is there a general agreement that FAA research is going to be negatively impacted by using the trust fund to cover 85 percent of the FAA budget? Is that the universal view of those on the panel—that this is going to present difficulties, strain on research funds and have a long term negative impact? Mr. Gormley?

Mr. GORMLEY. If I might just take a crack at it, I shouldn't think that that would be a problem.

Mr. TORRICELLI. You do not think it would be a problem?

Mr. GORMLEY. There is certainly a difference of views among the members of the panel as to what the percentage of funding from the trust fund should be in order to meet the overall FAA budget, but within the allocation of resources, the authorization by this committee, we shouldn't think that would be a problem because certainly within any breakout of the monies allocated for the various functions—assuming the total doesn't exceed 100 percent—the correct amount could and should be appropriated to the FAA R&D functions.

Mr. BROWN. Mr. Chairman, we feel there is a potential problem and that is that Federal dollars are scarce. We believe that these capital programs, whether it's RE&D, the F&E accounts or the AIP accounts, should have priority funding from the trust fund. In fact, that was the intent of the trust fund.

As you probably know, having looked at government over a long period of time, these O&M accounts tend to be a sponge that sops up a lot of resources if they are not closely monitored and carefully controlled. We would hate to see that priority and a shift of the O&M account from the capital investment program.

I think it's clear to all of us who have any relationship at all with the aviation system that we need investment in this country for capacity and to solve some of our current problems.

Mr. TORRICELLI. I want to ask just a series of general questions before I yield to Mr. Rohrabacher, and anyone please respond to them as appropriate and as meets your own interests.

Is there a general agreement that the problems of the human factor, the constraint to the air control system by the over-reliance on individual controllers, what the elements of that might be and how to better use and recognize the limits of the human role, is not sufficiently researched or understood? Can I get an reaction to that?

Mr. HOOVER. I'm Bill Hoover from the Air Transport Association.

I think that the capability, the fundamental human capacity of the air traffic controller, is a constraint, if you will, on the system and I think it does suggest that we do more in that effort in terms of human factors and in terms of providing automated decision-making assists to those controllers to give them additional tools to work with.

Mr. TORRICELLI. Is it a universal view that indeed we have reached the limits for human potential and that the technologies now being developed may in fact, in some cases, be making it worse rather than better and there is more to be understood about the human limits?

Mr. BROWN. Mr. Chairman, I think clearly there is more to be understood about automation and how machines can assist controllers, but I think the benefit is essential. The fact of the matter is that the human does have some limitations in terms of processing and control. The fact is that we have a largely tactical system today.

If we are going to get to a strategic system that has some capacity increase and some efficiency to it, there is going to have to be some automation to help these controllers. That having been said as the goal, there is a troubled path to get there.

As I mentioned in my commentary about human factors, there is a lot of research that needs to be done in that area to make sure we have the optimum level of automation and assists for the human, whether it's a pilot—such as John O'Brien and I are familiar with—or whether it's a controller or some other human element in the system.

Mr. TORRICELLI. For example, what I'm talking about, if I'm quoting properly Mr. Gormley said that the best automated systems are those that provide advisories to controllers— they can either accept or reject.

Is that indeed what the next generations of technology should be where we are succeeding in providing more advisories and more information to the individual controller who already may be receiving more information than they can possibly deal with?

Is that, in each of your estimations, what it means to improve technology or is the improvement of technology really not an incremental step, but indeed, a radically different step that allows the controller to have more time to make better judgments with information that is being handled more on an automated basis where there are less decisions to be made?

Mr. PORITZKY. May I try that one?

Mr. TORRICELLI. Yes.

Mr. PORITZKY. FAA has been at work on development of automation systems for about 30 years. There is no automation of the air traffic control process in existence now in the U.S. system or anywhere else in the world.

It's clear from what's been said here that controllers have limits on the number of variables, the number of airplanes, they can handle, just as pilots have limits on the number of tasks they can perform. As traffic demands grow, and human beings haven't changed, it's necessary to try to help the controllers—and also the pilots—by making their jobs simpler.

One can talk about, and people have talked about, it for many, many years, really making things automatic. Nobody ever defines what that means. It has a sort of nice sound about it. The reality is that we don't know how to do that and probably shouldn't.

The steps that have been talked about in our collective testimony which say let's help the controller, let's give him tools to assimilate more information to make wise decisions on a routine basis, are the directions to go.

I want to say one other thing while I have the microphone. There has been a fair amount of discussion here already about the value and the beauties of long-term research and automation and human factors is one of those.

I suggest to you that we have been doing it almost forever and that while I certainly have no objection to searches for innovation, all too often long-term research— as it's defined in these halls—is smoke and mirrors and we've got real problems. We've got a specific problem in helping controllers cope with more airplanes. That is a real here and now, day-to-day problem that requires research and implementation.

I would much prefer to have us talk about the research needed—long term, near term—to create improvements in the system than to think about long-term research because it sounds so nice.

Mr. TORRICELLI. I don't think anybody was talking about it because it sounds nice; I think it's because we believe we've got twin objectives. We have a near crisis in our hands now that requires incremental improvements in known technology to deal with this reality and simultaneously, we need to develop the next generation of systems.

My questions were leading to a point that in the next generation of systems, it appears to me the air traffic system should be at least as automated as a modern subway system where indeed it is where the trains are, at what speed they are going, how do they react to each other and their general conditions, are all monitored on an automated basis.

The role of the controller is to sit and watch the screen and make sure the machine is doing its job.

Tankers are entering our ports, subways are under our streets on systems that in some respects at least challenge my imagination—the level of automation—more than what I know about our air traffic control system. We have an enormous human reliance, it appears to me. While we can improve it, we are going to reach real limits of it. That is the point I was making.

My hope is that the FAA simultaneously works on both problems. That is the point I was trying to make.

Mr. HOOVER. If I could comment and pick up on one point, I think the technology is out there, be it short term or long term. The problem is trying to transition from our research and development activity into an operating system.

The combination of perhaps not planning for success in our R&D programs in FAA and the procurement system guarantees that anything we have on the drawing board today is a minimum of 10 years away. That makes it a long-term research as far as we're concerned. As Mr. Poritzky just said, we have a system out there that needs help right now.

Mr. TORRICELLI. In fact, given the level of investment being planned in the current system, we are—as you said— planning for its postponement. People are not going to want to replace the things that we are now doing. We are assuming that it will almost be incremental, so we are putting it to the horizon.

Mr. PORITZKY. If I could just jump in once more, since I've been watching the aviation system—which has been a number of years—I think I've learned, and I think the community has learned—that change in our system is evolutionary because it has to be. There are not really any evolutions; there never have been. It's been stepwise with very great caution because we're dealing with safety systems in every instance.

Bill said better than I said a moment ago that the technology is there. There is no need, in my opinion, for a great deal of research in satellites, for example. They are here, we know how to use them.

The problem is in biting the bullet and in fact, doing it, implementing, making that difficult and expensive transition to their use.

I get very nervous if I hear about more fundamental research in satellites. We don't need that. We need to find ways to use them beneficially; automation very much the same way.

Mr. TORRICELLI. Mr. Poritzky, you're all professionals in this, and I am not, but help a layman understand.

Given the size and speed of computers today, the ability to have America on an entire network of instant communications among those computers, the accuracy of radars, and the use of satellites, why is it not possible for a plane to take off from Los Angeles on a determined flight path, fly all the way to New York with all of its flight systems monitored automatically—from its fuel to its speed—fed back and told what approaches it should take all the way into a landing with the controller sitting back and watching only when some bit of information comes back that raises concerns, simultaneously monitoring every other airplane in the sky?

I don't know how many bits of information that is, but I know they all can fit today on a supercomputer and I know the network exists optically around the country for that to be fed back and forth or through satellites. Why isn't the system being built?

Mr. PORITZKY. I think what you've described is something that's possible but not likely.

Mr. TORRICELLI. Why?

Mr. PORITZKY. Not likely because the one major element in this is the weather. The weather is the one we don't know about very well, variations in winds aloft, variation in approach speeds, variations in the capacity of the airports, our dynamically varying and vary continually.

The beauty of our air traffic control system, and it's really pretty good when you think about how many airplanes it handles, is that it does use human ingenuity to a very significant degree, both on the controller side and the pilot side.

The experience certainly in the early attempts at automation that have been made by FAA and by others is that they introduce a rigidity which gets you a little less capacity than you already have in a number of historical instances I can site to you.

I believe, at least, and I think I'm not alone, that what we're looking for is that best combination of the machinery you describe and the ingenuity of the human being on top of it. I think you really want both.

Mr. TORRICELLI. Anyone else want to comment? Mr. O'Brien?

Mr. O'BRIEN. I think we learned some hard lessons in this area looking at cockpit crew performance and the introduction of different levels of automation. We are about to change— at least some people think we are about to change our philosophy on automation in the cockpit and use a technique that some refer to as human-centered automation.

What that revolves around is identifying first what the human does best and how can the automation help the human do the job that he or she does best and then find out what the human does least best and see if we can automate that function to the utmost.

Mr. TORRICELLI. But we're not doing that?

Mr. O'Brien. We did not approach the problem from that direction when we introduced automation into the cockpit. We have not looked at the ATC system from that direction at all. Looking at human performance within the ATC system is far behind looking at human performance in the cockpit.

Mr. Brown. Mr. Chairman, and I think John would agree, this is certainly true in general aviation which is a little different environment than he's familiar with. Through the studies that have been done for automation in general aviation cockpits, we found that the optimum automation level to support the pilot is far below the technologically achievable level simply because of the fact the pilot does have to have some involvement, that he needs and assist, but he can't handle all of the automation that in fact could be brought on- line that any engineer or scientist could develop. There are some tradeoffs.

Mr. Torricelli. Finally, Mr. Hoover, if the V-22 aircraft recommendations are accepted and administration of its program is terminated by the Defense Department, will there, in your judgment, independently be a tilt-rotor aircraft developed commercially in this country in the near term?

Mr. Hoover. I think it is less likely certainly. The airline industry has not found the economics yet that seem to attract it to the tilt-rotor use. There are some major questions, I think, that still need to be resolved in terms of its certifiability for commercial passenger use.

I think it was, from our standpoint, a good situation when the Defense Department was in fact pursuing that development. I think the funding that would be required to pursue it outside the Defense Department, if it was to come from a Federal source—the FAA, for example—I think we would find that, in our view, would be taking funds away from higher priority efforts.

Mr. Torricelli. If we adjusted the economics by local authorities making landing sites available for example, if there were a convenient New York/Washington/Boston site for a vertical aircraft that for people who were prepared to pay a premium, more convenient than current sites therefore requiring much less time for transportation, is the technology such otherwise that it would lead to commercial development?

Mr. Hoover. I think there are still some questions in terms of it being able to be certified that need to be answered. The technology, I think from a development standpoint, is probably there. I think the DOD would say they have done all that needs to be done in terms of the technology.

Mr. Torricelli. But you don't see commercial builders out there who are at all ready to pick up?

Mr. Hoover. Not in the airline industry, no.

Mr. Torricelli. Do you at all internationally?

Mr. Hoover. Other than I hear the Japanese are interested, as they are in most anything it seems, but I have not heard of any immediate interest.

Mr. Robeson. Excuse me. For some reason my name was left off the witness list. I'm Bob Robeson, Vice President, Civil Aviation at Aerospace Industries Association.

Mr. Torricelli. I apologize.

Mr. **Robeson**. No, I think the short circuit was on our end at some point.

We represent the manufacturers of large civil aircraft engines and also rotor-craft, a term which we use because that includes the V-22 type of aircraft as well as conventional helicopters.

My own personal view is that if this aircraft is not produced in the United States, it will be produced somewhere else. I think there is interest in Europe in producing it under Eurofar and there is interest in Japan in producing a tilt-rotor or a tilt-wing. There are questions of certification but I think that those can be surmounted and I think if there is any question about the willingness of European governments and Japan to support their industry, one should look at initiatives supported by MITI in Japan on the number of aircraft projects and the support that the European governments have given the Airbus program which at last count, by our tally, is somewhere in the neighborhood of $15 billion not counting opportunity costs.

Mr. **Torricelli**. Is there any engineering that seems to be moving towards development of a prototype either by European manufacturers or in Japan?

Mr. **Robeson**. There is certainly preliminary work. How far down the road they are to starting to bend metal, I think the guesstimate that we see is that they are something on the order of two to three years behind us at least.

Mr. **Torricelli**. Mr. Rohrabacher?

Mr. **Rohrabacher**. Thank you, Mr. Chairman.

Perhaps the questions on the tilt-rotor should have been directed at the last panel when we were talking about the potential bringing down of the noise at our urban airports.

Mr. Poritzky, you were mentioning that the technology potential is there but we're just not reaching this potential and we are not implementing some of these things. Once the global positioning system has been finished and we have the satellites in place for the system, are you confident that we are going to be reaching our potential and that the industry is ready to take full advantage of that system?

Mr. **Poritzky**. I can speak more easily about the first half of that. I believe that the global positioning system— especially if it's used in connection with the GLONAST system which is an equivalent Russian version and some satellites from the Europeans, and they can all work together—will create a navigation capability for the world which will be very difficult to resist.

It can provide us, at the very least, with an accuracy of 100 meters anywhere in the world ground to God. I think it will catch on very rapidly, not only in aviation, but in many, many other applications as well.

From the perspective of airport operators, we think it's absolutely a major benefit because what it will provide is the navigation capability for a nonprecision approach, and maybe better than that, to any runway in the world. That will create virtually a revolution in aviation, we think.

Mr. **Rohrabacher**. What about the second half of my question, are you confident we're going to actually utilize this potential to its fullest extent?

Mr. Poritzky. I believe so. I think the attractions are very great indeed for all kinds of applications in aviation.

Mr. Rohrabacher. I agree with your enthusiasm. I too am anxious for that system to be complete and I'm sure most people agree that it will probably bring about a more dramatic change in aviation than perhaps anything in the last 50 years.

Let me ask you if you could give us a couple examples, specific examples, where you believe that we have the potential and that the technology is there but we are not using it, it is not being implemented?

Mr. Poritzky. That's easy. I think the application— again, let me stay with the satellite arena—the application of satellite-based automatic dependent surveillance over oceans is an arena which, in my view, should have been completed three or four years ago, should be in use now, and the facilities on the ground should have been there, in my view, a number of years ago.

We are liable in the United States not to be the first to implement and I think we damn well should have been the first to implement.

I would touch on terminal automation perhaps as a second example.

Mr. Rohrabacher. Before you go to your second, what would that first give us the ability to do that we don't have today?

Mr. Poritzky. It would give us continuous information about the location of aircraft on the oceans—first on the oceans, you can also read Alaska or you can read South America or South Africa, wherever. It will also permit us to communicate essentially instantaneously and full-time with any aircraft operating on the oceans. Again, that's a major step. It's a technology that's here, that's been here for 10 or 15 years approximately and I believe we should be using it.

Terminal automation is another arena. Jim Gormley, in his initial statement, talked about the need to move toward automation, human-centered automation, as John O'Brien said it, which I believe is desirable and possible.

FAA, in its zeal understandable to develop the NAS plan, essentially stopped concentrating on research and development as Jim said. They are beginning now to look again at terminal air traffic control. Some aid to the controller in that busiest part of his job is possible now, would have been possible 5 or 6 years ago.

Mr. Rohrabacher. The technology is there already?

Mr. Poritzky. The technology is there. The development, implementation, and transition are lacking.

Let me add one sentence to that if I might. I was going to make this comment earlier but let me take the opportunity. Jim said that the FAA reorganization, the current reorganization, is a very positive thing, and I think we all agree that those are major steps in the right direction.

The one problem—and it's touched on in the extended version of Jim's testimony—is that the technical capability within FAA has deteriorated drastically over the years. There are far too few competent, capable technologists in FAA to do the job to meet the challenges they have.

I would urge certainly, and my association would urge, that whatever you can do in the reauthorization to give FAA the power to hire competent, up-to-date scientists and engineers would be very much worth all of our while.

Mr. ROHRABACHER. Those scientists and engineers should be aimed at implementing what we have rather than trying to discover new things?

Mr. PORITZKY. Both. I think I want them to do both and in the ratio that's been talked about—85/15.

Mr. ROHRABACHER. Just one last thought and that is, during our hearings about Japan—the Chairman will attest to this—we keep hearing that the United States actually does not lack basic research but that where we are really falling behind is actually putting into practice the things that we already know. It sounds like that is what we are hearing today as well.

Thank you very much, Mr. Chairman.

Mr. TORRICELLI. Thank you, Mr. Rohrabacher.

One final question, if I could. Would a new airway structure such as the earth reference grid system enhance the efficiency of the ATC?

Mr. BROWN. Mr. Chairman, I think undoubtedly it would. It's going to take a little time to put into place but clearly what we're going to end up with is a system that doesn't have as much tactical control, as many errors and circuitous routings, delays and those kinds of imperfections in it.

We're going to get closer on the continuum from tactical to strategic toward a system that's more pre-planned, more automatic, more predictable and therefore has better flows and more even flows in it and will be of great benefit to the users as well as to the Government.

Mr. TORRICELLI. Mr. Brown, help me understand, that 70 percent of pilots who do not have LORAN systems on board, would you breakdown for me by what means they are navigating?

Mr. BROWN. Primarily, they are navigating on a previous generation of technology which is a VOR/DME.

Mr. TORRICELLI. What percentage of the 70 would be using that?

Mr. BROWN. Probably about 50 percent. By 50 percent, I mean total of the 70 remaining, 50 percent.

Mr. TORRICELLI. And the remainder?

Mr. BROWN. The other 20 percent are primarily using visual navigation. They tend to fly on a local basis over short distances. For instance, I flew up to your part of the country over the weekend and you know on Sunday it was a nice day, and radio navigation wasn't necessary. I communicated with air traffic as appropriate but I flew using visual navigation, referring to the coastline, major cities, other very commonly recognizable items.

I might add, Mr. Torricelli, visual navigation is probably the safest form of navigation of all because the pilot is doing what he should be doing and that's looking outside the cockpit and it facilitates that.

Mr. TORRICELLI. I navigate my sailboat that way but I only go to 4 knots.

[Laughter.]

Mr. TORRICELLI. Mrs. Morella, a member of the committee, is going to correspond with members of the previous panel with questions regarding noise. At this point in the record, I'd like to submit her letter and the answers that we received from the two panelists.

[The question of Mrs. Morella and the answer thereto follow:]

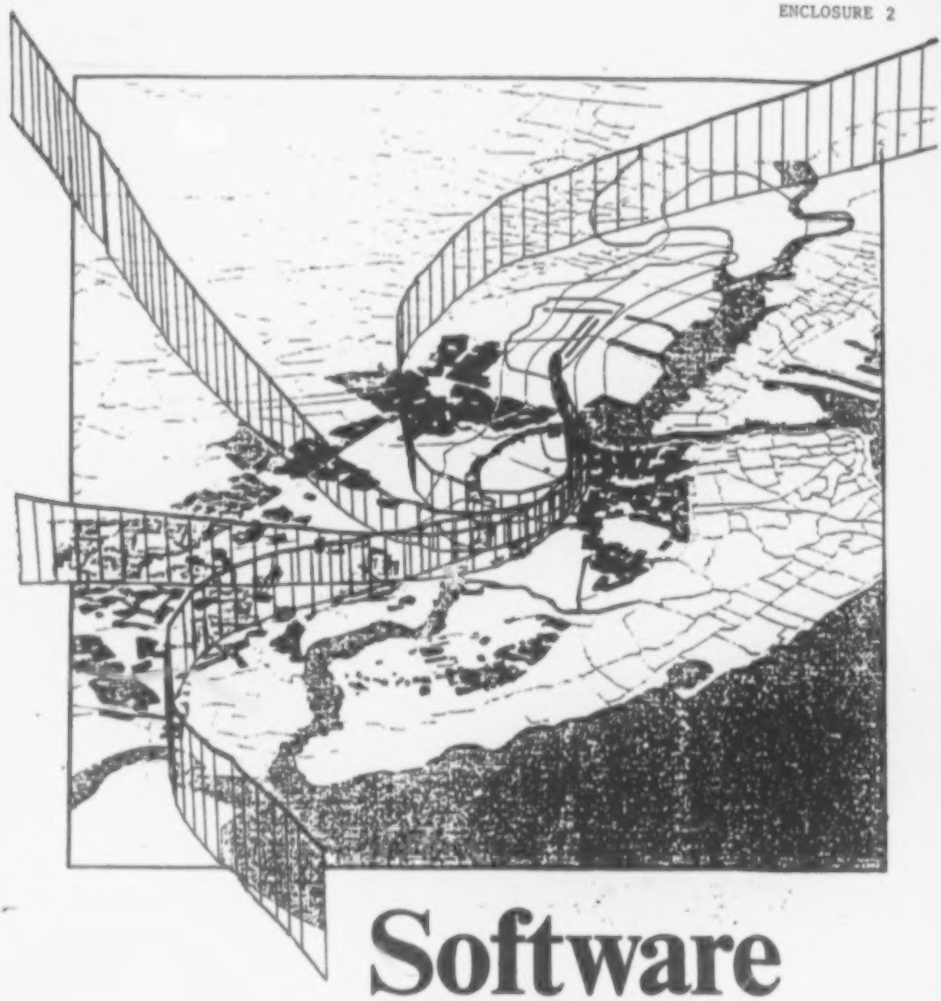
RESPONSE TO REPRESENTATIVE MORELLA'S QUESTION FOR THE RECORD

Question: Is anything being done technically that will enable airport operators to readily combine radar flight track data with aircraft noise measurements so that violators of airport specific noise rules can be readily identified?

Answer: Several airport consulting firms have developed hardware and software packages to enable airport operators to address airport and aircraft operational issues, including noise. One firm in particular has developed a system for extracting aircraft flight data from the Automated Radar Terminal System (ARTS). The FAA participates in this particular system by providing the ARTS diskpack or magnetic tapes. The flight information is then combined with noise measurements from the airport's permanent monitoring system to provide the analytical capability for appropriate measurement.

Attached is a detailed description of the capability of one such firm.

ENCLOSURE 2



Software Profile Descriptions

Landrum&Brown

Preface

The single most limiting factor to the growth and development of the nation's airports has been the public controversy caused by aircraft generated noise. Although aircraft noise is being reduced through local noise abatement actions and newer technology aircraft, vocal citizen opposition continues to grow.

Aircraft noise has been a continuing subject of study, producing many technical reports, scientific measurements, analyses, and Federal legislation. However, airport operators have borne the brunt of noise impacted citizen activism, costly legal challenges and a growing number of discontented airport neighbors. Because airport noise is an emotional issue, as well as a technical one, airport management has an extremely difficult task of managing noise issues and communicating effectively to those airport neighbors most impacted by aircraft noise.

Landrum & Brown has developed a series of software tools designed effect better communication by airport management through the recording, measurement, and assessment of aircraft noise impacts. This information can then be presented in lay terms and illustrations which aid in the management and communication of aircraft noise issues.

The software described in this manual is available on a contract basis or can be licensed for use. All of the packages operate on a desktop personal computer with DOS version 2.1 or later.

This handbook has been prepared to describe Landrum & Brown's various software packages which will assist airport managers in addressing airport noise and aircraft operational issues. The programs are not a cure for the these issues. However, they are intelligent tools that can be use for the analysis and communication of complex issues to those who create the noise and to those who are negatively affected by it.

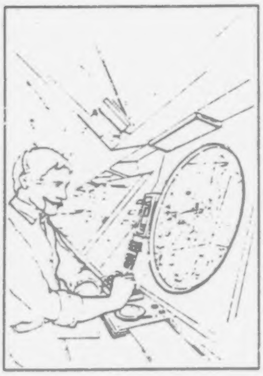
The following profiles describe each software package, their use and capabilities. For further information, please contact one of Landrum & Brown's offices:

Mr. Stuart S. Holder
11279 Cornell Pk. Dr.
Cincinnati, Ohio (513) 530-5333

Ms. Mary L. Vigilante
20 N. Clark Street, Suite 2200
Chicago, Illinois (312) 726-4967

Mr. James A. Talley
6151 W. Century Blvd, Suite 1000
Los Angeles, California
(213) 645-6447

Radar Data Acquisition System



The most accurate source of actual aircraft flight data is the Federal Aviation Administration's radar system, known as Automated Radar Terminal System (ARTS). Through working with local FAA officials, it is possible to use this data for analysis purposes. Landrum & Brown has developed cost effective systems that enable airport operators to extract and process radar data on a periodic or continuous basis.

Landrum & Brown's Radar Data Acquisition System consists of all hardware, the extraction software and training required to read and process standard FAA radar data in disk or tape format. Currently, radar data is not available for analysis immediately (not as the event occurs); data is only available after a 15-day "cool down" period.

Landrum & Brown's Rad
Acquisition System provid
information such as:

- Runway used
- Time of operation
- Aircraft type
- Beacon number
- Arrival/departure fi
  ment
- Airline name an
  number (or gener
  tion N number)

Once the radar data has
quired and processed wi
drum & Brown's Rad
Acquisition System, it can
with other Landrum & Br
ware packages to perform
operational evaluations.
modular packages includ

- Flight Tracking -
  Tracks
- Ground Track E
  ment
- Vertical Grid Ana
- Noise Event Corre
- Approach & Clim
  Assessment
- Aircraft Operatio

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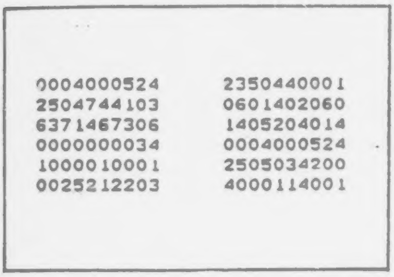

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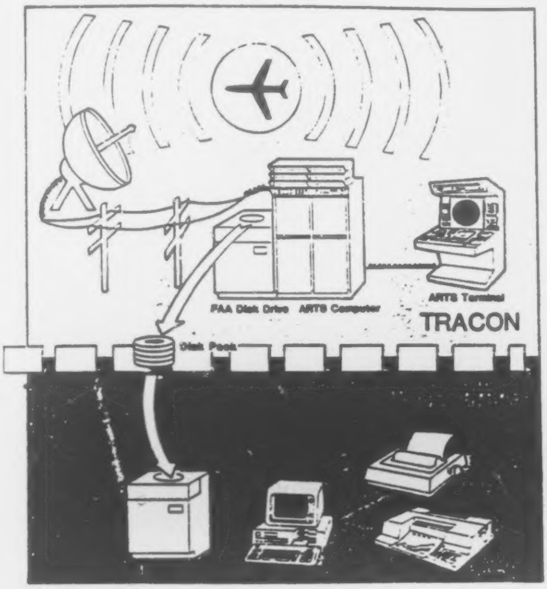
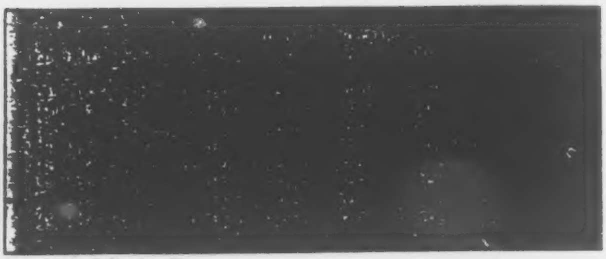
Unprocessed Radar Data


FAA Disk Drive
ARTS Computer
ARTS Terminal
TRACON
Disk Pack

System Flow Diagram



Processed Radar Data

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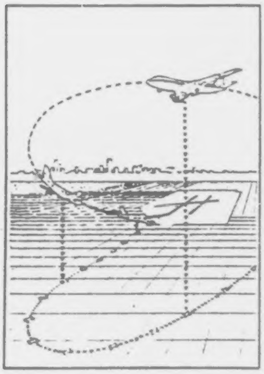
Flight Tracking - Ground Tracks



An integral element in modeling aircraft noise is the definition of the flight tracks, or projections of the aircraft's path along the ground. By using actual radar data, the airport operator can answer questions concerning when aircraft are initiating turns and provide an accurate definition of general flight corridors. Analysis of this data over a period of time allows the airport operator to evaluate the effectiveness of noise abatement procedures.

Landrum & Brown's flight tracking module allows data extracted using the Radar Data Acquisition System to be evaluated in a number of ways. Users of the module can examine flight tracks by defining specific characteristics such as aircraft types, airlines/airport users, time of day, and/or runway end or mode of operation (arrival or departure). To provide clear illustrations of the flight tracks, plotting can be scaled to match existing basemaps, and flight tracks can be color coded to aid in the comparison of various conditions.

In evaluating the ground trac
a given airport, the underlyin
characteristics are of impor
The basic ground track syste
lows users to define a limited
ber of general land use o
graphic reference points s
noise monitoring sites, navig
aids, major roadways, noise
tive facilities or the airport b
ary. Enhancements to the g
underlay display, which pr
greater definition of the are
rons, are available as descri
a following software p
profile.

The software will perform p
a computer screen or to pap
A tabular report is produ
lowing airport operators t
tify the user of each track.

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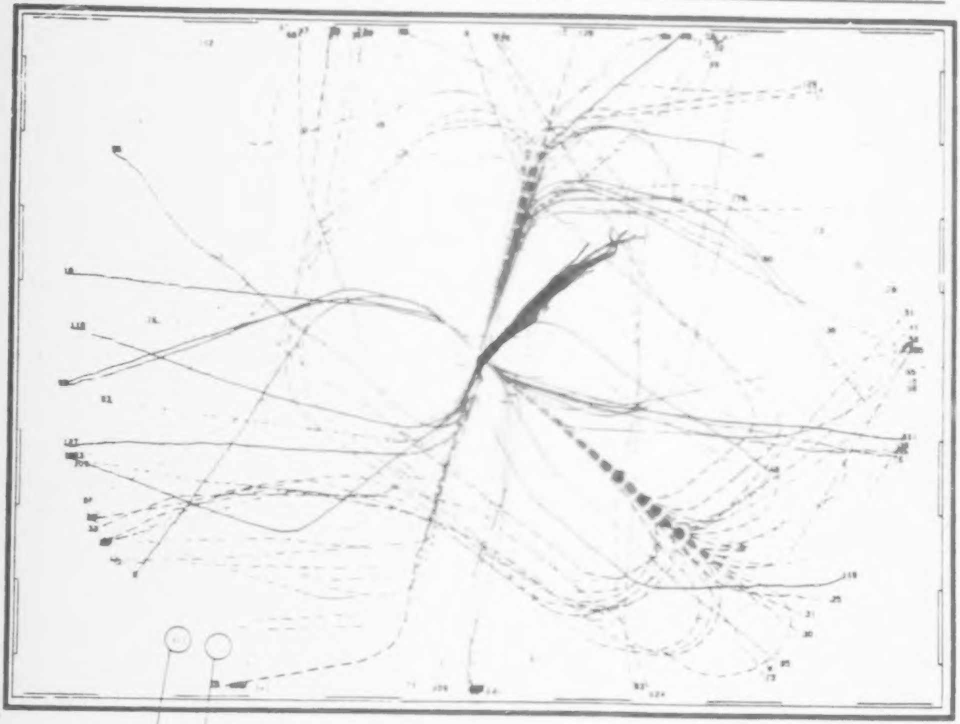
Example Aircraft Ground Track Plot



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FIRST ARTS PROCESSING
ALL ARRIVALS AND DEPARTURES
ARRIVAL/DEPARTURE MODE = ALL Arrivals and Departures
RUNWAYS SELECTED ARE: 02R, 02L, 13 , 20L, 20R, 31
ARTS TIME PERIOD PROCESSED = SEP 10, 1987  6:59 TO SEP 10, 1987 10:59

                                   AIRLINE   AIRCRAFT
 TRJ | RWY | A/D |   TIME    | ID        | TYPE     | FIX | FXALT | BECN |
  99 | 20R | DEP |   9:52:32 | AA931     | MD80     | XCY | 35000 |  765 |
 100 | 13  | DEP |   9:53:32 | AMW4501   | SW4      | XTN | 15000 |  763 |
 101 | 20R | DEP |   9:54:11 | AMW4443   | SW4      | XCY | 14000 | 5572 |
 102 | 20R | DEP |   9:59:21 | AA943     | B727     | XCY | 24000 | 5563 |
 103 | 20R | ARR |  10:06:03 | SWA438    | B737     | GNM | 33000 | 7321 |
 104 | 13  | DEP |  10:00:40 | AA941     | MD80     | GUN | 33000 |  766 |
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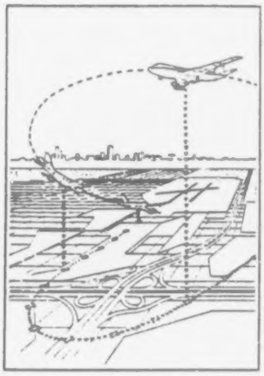
Ground Track Enhancement Package



To enhance the presentation of ground tracks relative to geographic features surrounding an airport, a separate ground track enhancement module is available. This module facilitates the presentation of various airport operational characteristics with land use and geographic characteristics through the use of computer aided mapping system data files. The geographic information layer can include extensive information concerning surrounding neighborhoods, census tracts, land use etc. The enhanced version allows the user to eliminate the problem of a "sea of spaghetti", with no or limited reference to the underlying environment.

Also included in the Groun Enhancement Package is t ity to conduct flight corrid pliance evaluations. One most difficult questions t public asks involves ide aircraft overflights of an are noise abatement procedur hibit" such overflight. Lan Brown's ground track com monitoring allows the operator to identify s occurrence(s) of aircraft ov that did fall within a pre area.

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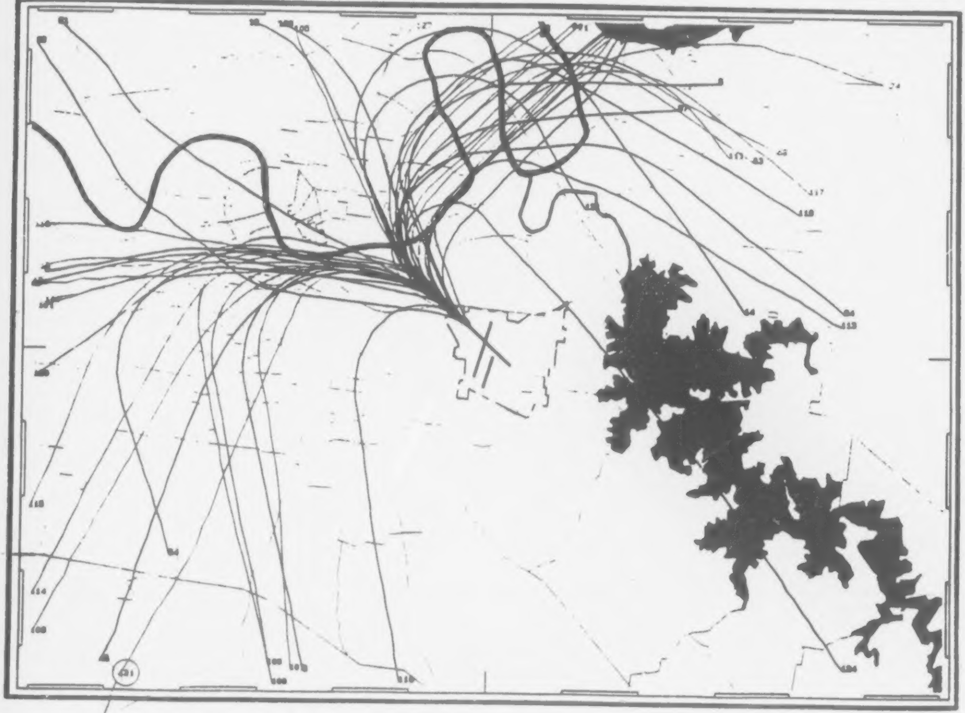
Example of an Enhanced Ground Track Package showing land use characteristics



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RUNWAY 31 DEPARTURES
ARRIVAL/DEPARTURE MODE = ALL Departures only
RUNWAYS SELECTED ARE: 31
AIRLINES SELECTED ARE: PA, SW, TW, AM, PA, BK, EA, NW, AA, DA
ARTS TIME PERIOD PROCESSED = OCT 31, 1987 15:59 TO OCT 31, 1987 23:00

                                 AIRLINE   AIRCRAFT
 TRJ | RWY | A/D |   TIME   |  ID      |  TYPE    | FIX | FXALT | BECN |
 119 | 31  | DEP | 20:53:06 | AMW4621  | E120     | SAV | 15000 | 1546 |
 120 | 31  | DEP | 20:54:49 | DAL657   | B737     | VAL | 35000 | 1521 |
 121 | 31  | DEP | 20:56:09 | AAL959   | B727     | XCY | 39000 | 1505 |
 124 | 31  | DEP | 21:06:01 | BKA641   | AC69     | GUM | 17000 | 5660 |
 126 | 31  | DEP | 21:09:41 | TWA275   | B727     | TEA | 31000 | 5625 |
 127 | 31  | DEP | 21:26:08 | EAL459   | DC9      | GUM | 29000 | 5603 |
 131 | 31  | DEP | 21:56:44 | DAL591   | B737     | GUM | 25000 | 1543 |
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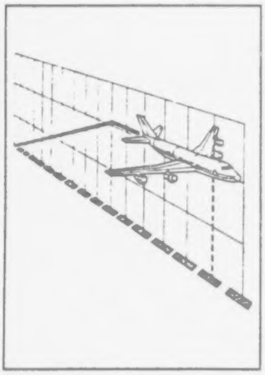
Approach and Climb Profile Assessment



In performing a noise assessment, the accurate definition of the aircraft's climb performance is essential. Many airport operators hear questions and statements concerning operations from their airport(s):

- *Aircraft are flying too low as they approach or depart!*
- *How high are aircraft as they pass over my home?*
- *Why is Airline X or aircraft type Z lower than the other aircraft?*

Landrum & Brown's Approach and Climb Profile module can assist in answering these questions.

Aircraft Approach and Cl
files can be examined in a
of ways. Individual or g
flights can be examined,
age profile can be calcul
overflights of a specific
be reviewed. These pro
then be compared to th
Integrated Noise Mode
performance database.

In addition to assessing
the Approach and Clim
module also identifies the
the aircraft. This inf
provides a comparison o
to speed/acceleration. I
tabular reports are pro
the Profile module.

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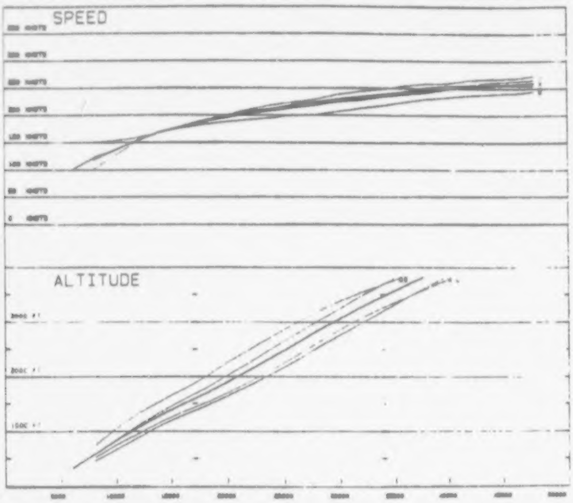
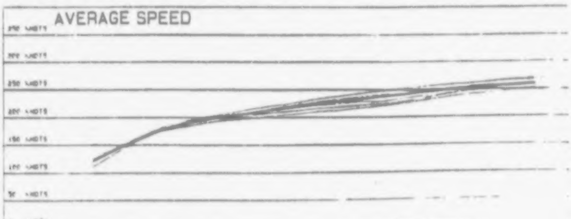
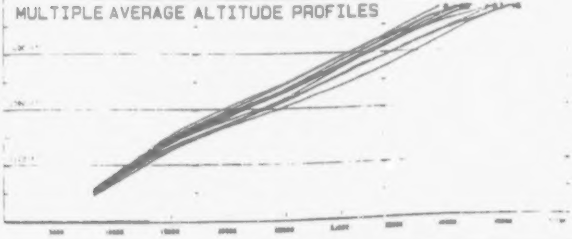


Specific Aircraft Profiles

TRJ	RWY	A/D	TIME	AIRLINE ID	AIRCRAFT TYPE	FIX	FIX ALT	BECN
13	31	DEP	16:58:42	AAL215	MD80	VAL	35000	1554
16	31	DEP	17:09:49	DAL511	B727	GLM	23000	1606
17	31	DEP	17:26:18	DAL903	DC9	VAL	35000	5632
21	31	DEP	17:48:35	EAL691	DC9	GLM	25000	5643
44	31	DEP	18:59:27	DAL376	B727	GAB	21000	5625
45	31	DEP	18:58:01	[illegible]	B737	PCY	35000	5637



Multiple Averages (Trend Analysis)



Comparison of average B-727 departures over several days

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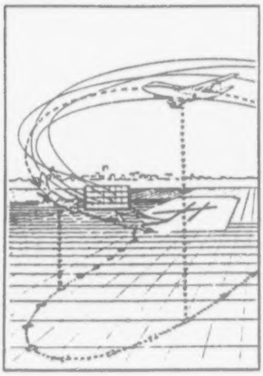
Vertical Grid Analysis



Once a noise abatement program has been established for an airport, it is important to monitor progress toward achieving the goals of the program. Landrum & Brown's Vertical Grid Analysis module will allow users to monitor the altitude and ground track at pre-defined locations. This vertical slice of the airspace allows airport operators to evaluate the location and altitude of aircraft relative to noise abatement procedures and noise sensitive land uses.

To perform this analysis, an airspace slice is defined similar to a football goal post. The right and left posts/up-rights provide a reference point to measure the deviations right and left of the preferred ground track. The base of the upright represents the desired minimum altitude. Operations w do not penetrate the goal pos analyzed relative to the goal A statistical analysis is perfor indicating where aircraft p trated the airspace slice relati the goal post.

Graphic plots and tabular rep are produced discribing the op tions through the goal post. addition, a database file is cre for further spatial analysis.

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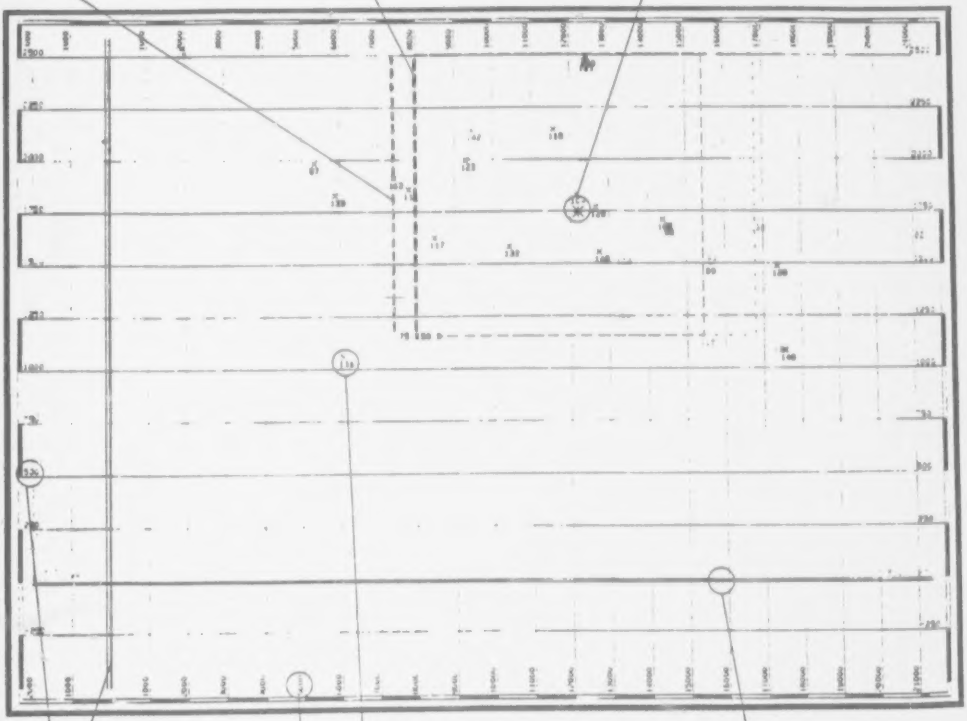
75% of operations penetrated within this area

50% of operations penetrated gate within this area

Average point of gate penetration for all aircraft operations



Right grid limit

Altitude above preferred track

Departure operations penetration point, located right of grid

Distance to the right of the preferred track

Minimum corridor Altitude

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3-Dimensional Flight Profile

Because of the intricate relationship between arrival and departures patterns, and the interaction within a system of airports, a 3-dimensional perspective of operations frequently aids the review of operational characteristics. Using data obtained with the Radar Data Acquisition System and the Land Use Monitoring and Mapping System, a 3-dimensional perspective can be created to illustrate these relationships. This perspective provides the airport opera with the ability to show the fli pattern relationships and their p jection over ground characte tics.

The 3-dimensional plots can viewed on a computer screen fore plotting.

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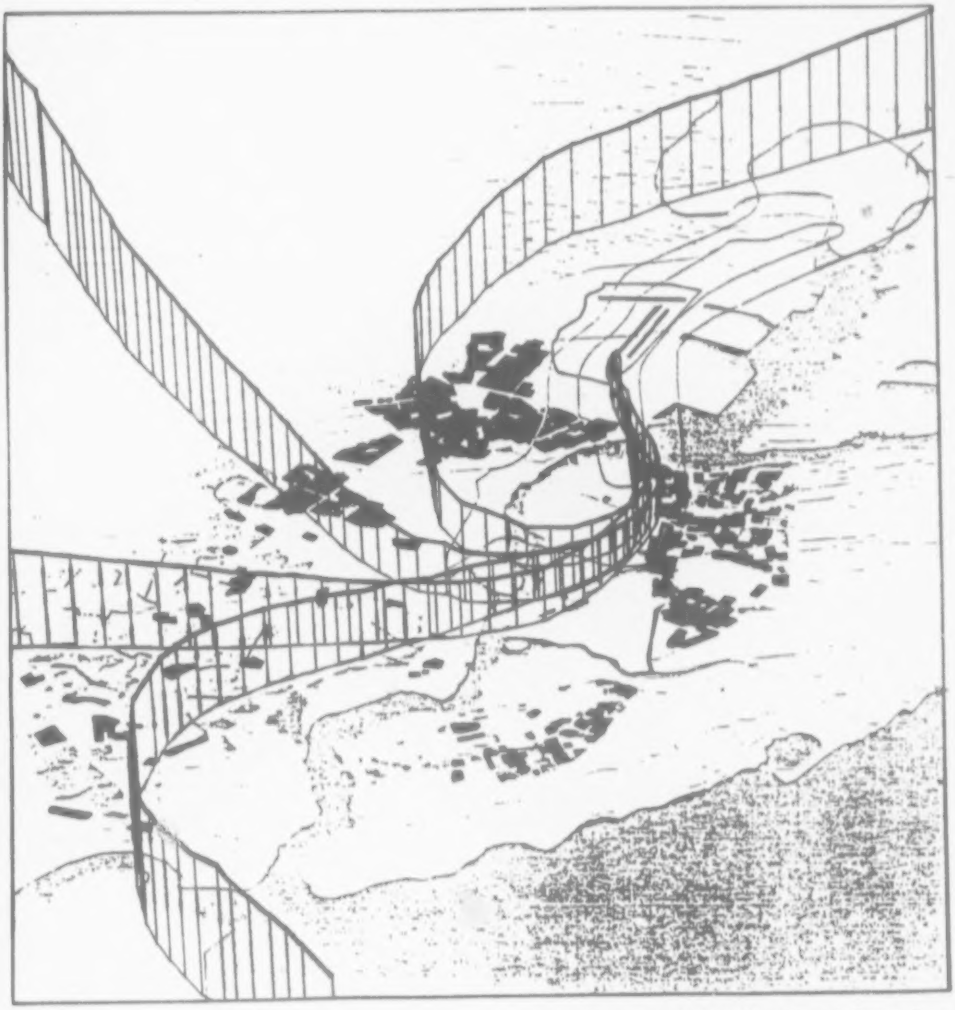
An example 3-Dimensional Perspective



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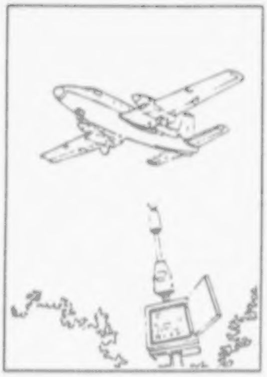
Noise Event Correlation to Aircraft Overflight –



FAA radar data can be combined with noise level monitoring data to determine the contribution of individual aircraft noise events. Tabular reports are generated which show the specific aircraft which resulted in the noise event.

The Noise Event Correlation module calculates the time that each aircraft flies closest to any noise monitoring site. The n event correlation system produ reports which present the time the peak aircraft noise event, m of operation (arrival/departu airline/user, aircraft type, run used, and noise level informat (peak sound level, SEL, etc). T noise level information is limi only by the data produced by noise measurement equipmen

Airport Operations Log and Noise Event Correlation
Summary by Date

Time	Type Oper	RMS	Aircraft Type	A/C I.D.	I.D. Type	Runway	Lmax	Allowed Level	Exceed Allowed Level
6:46:	D	6	BL26	GBMV	T	30	71	79	0.0
7:01:	D	6	B737	PW609	F	30	96	94	2.0
7:01:	D	7	B737	PW609	F	30	90	92	0.0
7:04:	A	3	DH7	TAF345	F	30	81	92	0.0
7:08:	D	6	PA31	AA238	F	30	84	94	0.0
7:08:	A	3	CV58	TAF372	F	30	89	92	0.0
7:11:	D	6	MU2	GMUK	T	30	81	94	0.0
7:11:	D	7	MU2	GMUK	T	30	81	92	0.0
7:13:	D	6	WW24	N819JA	T	30	89	94	0.0
7:13:	D	7	WW24	N819JA	T	30	81	92	0.0
7:16:	A	3	B737	PW437	F	30	86	92	0.0
7:31:	D	6	C550	GMTV	T	30	80	94	0.0
7:31:	D	7	C550	GMTV	T	30	76	92	0.0
7:35:	D	7	B737	PW654	F	30	93 *	92	1.0
7:38:	A	3	B737	PW541	F	30	91	92	0.0
8:02:	D	6	L188	NQ211	F	30	85	94	0.0
8:02:	D	7	L188	NQ211	F	30	86	92	0.0
8:06:	A	3	DH7	TAF340	F	30	80	92	0.0
8:24:	D	6	A748	FAMO	T	30	85	94	0.0

Sample Noise Event Correlation Tabular Report

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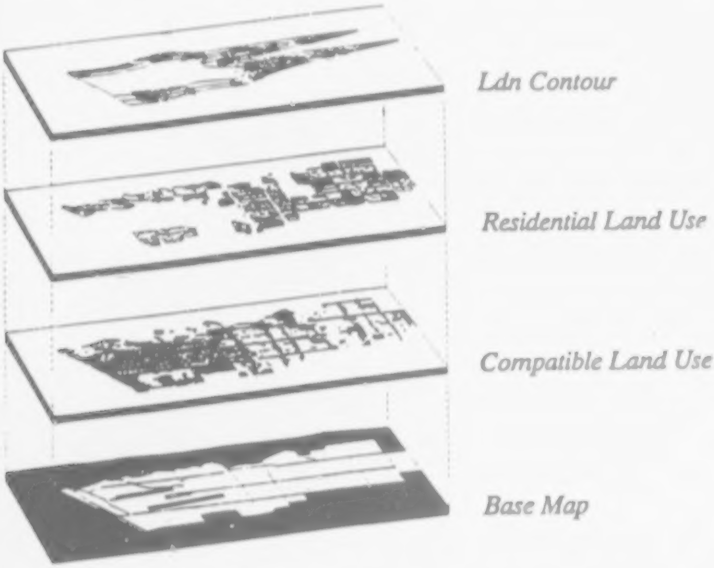
Land Use Monitoring and Mapping System

Computer aided mapping systems provide flexibility in modeling and monitoring population and land use characteristics in the vicinity of an airport. Landrum & Brown, in cooperation with the software developer GeoBased Systems, is marketing the LandTrak mapping system to the airport industry. LandTrak is a geographic mapping system currently used by city and county governments for land use monitoring, crime evaluations, emergency vehicle responses etc. Landrum & Brown has adapted it for use in modeling and tracking population and land use in the vicinity of airports.

LandTrak stores and displays 50 separate data layers. These layers, which operate like layers in a computer aided mapping system, can include streets, land use types, census tracts or blocks, political jurisdictions, noise sensitive facilities (schools, hospitals, churches etc), noise contours, flight tracks, etc. Data can be in a general form or as detailed as by the parcel level.

LandTrak will produce tabular summaries of data evaluated or generate maps to be plotted.



Example Data Layers for a Noise/Land Use Management System

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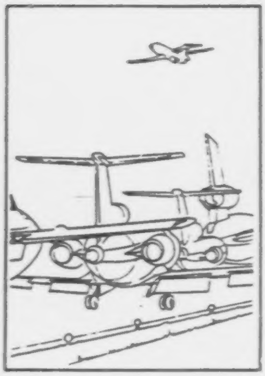
Aircraft Operations Log



Using FAA radar data, an Aircraft Operations Log can be developed with this module. The Operations Log, when combined with data from the Official Airline Guide (OAG), will provide a comprehensive listing of operations into and out of an airport.

The Operations Log and OAG data provide a listing of the following:

Radar Data
Runway used
Mode(Arrival/Departure)
Date and time
Aircraft type

OAG Data
OAG aircraft type
Origin/destination city

Once origin/destination is kno
the distance can be calculated.

The Operations Log can be u
to produce the following repor

- Daily reports
    - Summary of operations runway end
    - Number of operations hour/time of day
    - Operations by aircraft typ
- Quarterly/Annual
    - Summary by aircraft type
    - Summary by runway end

```
.............................................................................
ARR/          ARTS      OAG       ARTS      OAG       INM       ORIG/  G.C.
DEP   TIME    ID        ID        A/C TYPE  A/C TYPE  A/C TYPE  DEST   DISTANCE
.............................................................................
DEP   0632    COA820    CO820     B727      72S       72709     IAH         198
DEP   0636    UAL888    UA888     B737      73S       737017    MSY         389
ARR   0637    DAL636    DL636     B737      73S       737017    BTR         334
DEP   0639    DAL976    DL976     DC9       D9S       DC909     LIT         262
DEP   0640    DAL16     DL16      L101      L10       L1011     ATL         633
ARR   0643    ABX192    1M192     DC8       D8F       DC870     AUS         163
DEP   0648    DAL638    DL638     B73S      733       737300    HOU         217
ARR   0649    DAL1010   DL1010    B727      72S       727015    LGA        1203
DEP   0649    DAL500    DL500     B727      72S       727015    JAN         353
DEP   0650    DAL274    DL274     B727      72S       727015    MEM         374
ARR   0655    DAL276    DL276     B727      72S       727015    SAT         218
ARR   0656    DAL389    DL389     B73S      733       737300    SLC         868
ARR   0657    DAL227    DL227     DC9       D9S       DC909     IAH         198
DEP   0702    DAL332    DL332     B757      757       757PW     TPA         792
DEP   0704    AAL520    AA520     B727      72S       72709     MEM         374
ARR   0704    AAL258    AA258     MD80      M80       MD82      BNA         546
DEP   0705    AAL110    AA110     MD80      M80       MD82      AUS         163
ARR   0706    AAL90     AA90      B727      72S       727015    SAT         218
DEP   0707    DAL1027   DL1027    B727      72S       727015    CVG         702
ARR   0707    AAL548    AA548     MD80      M80       MD82      MSY         389
DEP   0707    UAL681    UA681     B727      72S       72709     DEN         557
```

Example Operations Log

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Noise Complaint Management System

One of the most time consuming tasks of a noise abatement office is preparing responses to aircraft noise complaints. To simplify this process, Landrum & Brown has developed an automated database management system to enter, assess and respond to caller complaints.

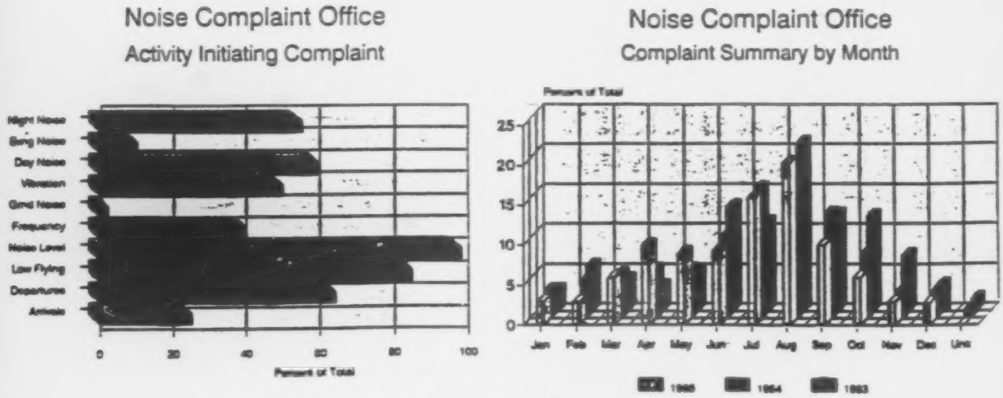
The noise complaint management system is tailored to each airport's noise complaint and response desires. The basic system allows the noise office staff to enter: the callers name and address, time of call, time of complaint, activity that was disrupted and the callers comments. The system contains options to permit the office staff to enter (or connect to another airport database) the runways in use, weather information, and other airport operational data.

At several locations the system has been tailored to develop an intelligent response that acknowledges runway use, runway closures and weather information to notify the caller as to possible reasons for the annoyance.

The noise complaint management system allows the noise abatement office staff to produce reports summarizing specific complaints by one or more political jurisdictions for any time period. Reports are available which list the number of calls by:

- Time of day
- Hour of complaint and call
- Type of noise(arrival, departure, ground run-up, etc)
- Activity interrupted
- Noise contour
- Political jurisdiction
- Day of week and month
- Runway Use

In addition to tabular reports, business graphic reports can be generated. Illustrations of noise complaint locations can be produced when the Noise Complaint managment system is used in conjunction with a geographic mapping system, such as Land-Trak.



Example Noise Complaint Management Business Graphics

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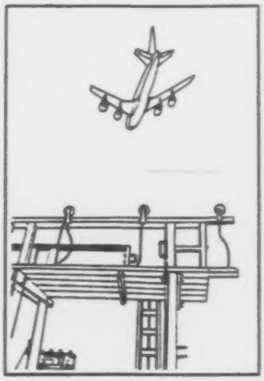
Integrated Noise Model Data Preparation

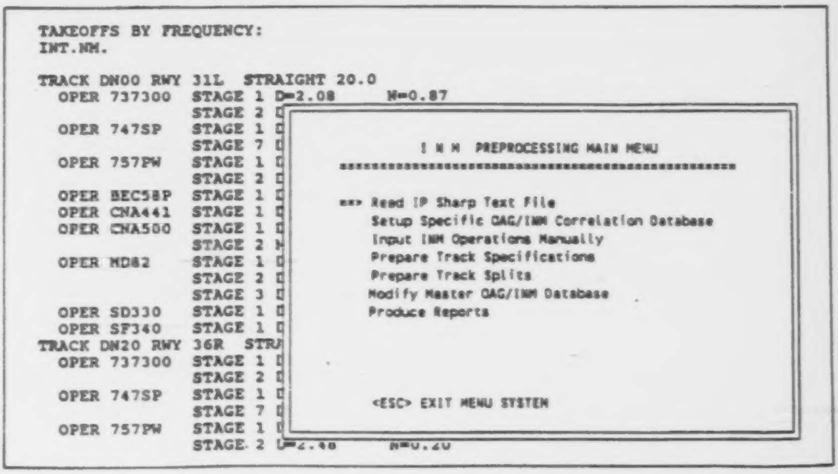


Use of the FAA's Integrated Noise Model (INM) requires a significant amount of data concerning the operation of an airport that must be translated into a specific format. Once the data is collected concerning runway utilization, flight track definitions and use, aircraft operations and fleet mix, it must be translated into the INM format, which can represent several thousands of lines of data. Landrum & Brown's Data Preparation software reduces the time and effort to create the bulk of the INM datafile (about 98 %).

The software is menu driven with the automation portion being dependent on user preference and availability of data. Using single screen menus, data is manually entered concerning:

- Flight track geometry
- Runway and track utilization
- Aircraft fleet mix

Computerized data from the Official Airline Guide can be processed and matched with the user entered data.



```
TAKEOFFS BY FREQUENCY:
INT.NM.

TRACK DN00 RWY 31L  STRAIGHT 20.0
  OPER 737300   STAGE 1 D=2.08      N=0.87
                STAGE 2 D
  OPER 747SP    STAGE 1 D
                STAGE 7 D
  OPER 757PW    STAGE 1 D
                STAGE 2 D
  OPER BEC58P   STAGE 1 D
  OPER CNA441   STAGE 1 D
  OPER CNA500   STAGE 1 D
                STAGE 2 N
  OPER MD82     STAGE 1 D
                STAGE 2 D
                STAGE 3 D
  OPER SD330    STAGE 1 D
  OPER SF340    STAGE 1 D
TRACK DN20 RWY 36R  STRA
  OPER 737300   STAGE 1 D
                STAGE 2 D
  OPER 747SP    STAGE 1 D
                STAGE 7 D
  OPER 757PW    STAGE 1 D
                STAGE 2 D=2.48      N=0.20
```

```
             I N M  PREPROCESSING MAIN MENU
==============================================

==> Read IP Sharp Text File
    Setup Specific OAG/INM Correlation Database
    Input INM Operations Manually
    Prepare Track Specifications
    Prepare Track Splits
    Modify Master OAG/INM Database
    Produce Reports



    <ESC> EXIT MENU SYSTEM
```

Example Data File Prepared With Software and a User Menu

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Mr. TORRICELLI. I thank each of you for taking this time today to help us in facing the reauthorization legislation. You've been very helpful and very patient. I appreciate your willingness to assist the committee. Thank you very much for being with us.

The committee stands adjourned.

[Whereupon, at 5:11 p.m., the subcommittee was adjourned, to reconvene at the call of the Chair.]

OVERSIGHT ON FAA's FISCAL YEAR 1991 R&D PROGRAM

THURSDAY, APRIL 26, 1990

U.S. House of Representatives,
Committee on Science, Space, and Technology,
Subcommittee on Transportation, Aviation and Materials,
Washington, D.C.

The subcommittee met, pursuant to recess, at 9:22 a.m. in room 2253, Rayburn House Office Building, Hon. Robert G. Torricelli [chairman of the subcommittee] presiding.

Mr. Torricelli. The meeting will come to order.

Good morning. Thank you for being with us this morning and welcome to the second day of the Subcommittee on Transportation, Aviation, and Materials hearings on the FAA's fiscal year 1991 budget authorization for research, engineering and development.

Being somewhat new to the subject of aviation technology, I, at least personally, found our last hearing to be extremely informative. We covered a great variety of issues in some depth, and are appreciative to both the members and to those who testified for rather an extraordinary session.

We heard wide ranging testimony on matters that concern, I think, many Members of the Congress from operations of airports to new technology to aircraft noise. I think it is clear from the response of members of the committee that aircraft noise is a significant and mounting issue, both in terms of technology and politically.

Solving that problem, or even reducing it, is going to be very difficult, yet I get a sense, despite the enormous interest—the technological interest as well—there is relatively little being done about it. The FAA's fiscal year 1991 budget request for the Aircraft Noise Reduction and Control Program is only $1.6 million, and the program appears to be focused on noise modeling rather than on either noise reduction or control. I am hoping that we will get to hear more about this from the FAA.

I am also concerned about the fact that this country's harbors and subway systems appear to have a higher level of technological and automation sophistication than the air traffic control system. I have heard many reasons for why that might be the case, but none have been very convincing. Most seem to suggest that it is just too hard to do. That is not a sufficient reason to avoid progress. President Kennedy once said in a speech that this country was going to go to the moon, not because it was easy, but because it was hard. I would like to see the FAA exhibit a similarly aggressive research attitude about improving generationally, not simply incrementally, our level of technology in air traffic control.

Unfortunately, the Adminstration's projected budget request for $190 million to $195 million for research and development over the next five years suggests the FAA's research and development program may find it difficult enough just to get off the launching pad.

Today we hear from the FAA itself, the FAA Research and Development Advisory Committee, and the Air Traffic Control Association. I am looking forward to the testimony.

With that, I would now offer opening comments to the ranking Republican Member of the subcommittee, Mr. Lewis.

Mr. LEWIS. Thank you, Mr. Chairman.

On Tuesday we heard testimony from the Commission of Aviation Associations. Their recommendation was that the FAA R&D Budget for fiscal year 1991 should be no less than $60 million. They also recommend an increase in the scientific and engineering personnel. The significance of the recommendation is that the groups with the most interest and expertise in aviation are united in their views in the need for stronger FAA R&D programs.

As many of you know, on Monday I visited the FAA Technical Center in Atlantic City. The progress in research over the past two years since my last visit is very good. I was pleased to see the research into the aviation fire hazards produced by aerosol cans that are carried on aircraft by passengers. This FAA-initiated study is exactly the type of research that will improve aviation safety. Moreover, it was begun without the aviation industry having to experience an accident, however, I am still concerned about the adequacy of funding and the scientific personnel levels of long-term research programs. Therefore, I look forward to hearing today's witnesses address these and other research related issues. I want to welcome today's witnesses, especially Joe Del Balzo who has done such an outstanding job in the FAA, particularity in this area.

Thank you, Mr. Chairman.

Mr. TORRICELLI. Thank you, Mr. Lewis.

To start with our first panel, if we could, Joseph Del Balzo, Executive Director for System Development, Federal Aviation Administration; Martin Pozesky, Associate Administrator for System Engineering and Development, Federal Aviation Administration; and Dale McDaniel, Deputy Associate Administrator for Policy and International Aviation, Federal Aviation Administration.

Gentlemen. Mr. Del Balzo, if you would like to begin. Each please, if you would like to make an opening statement remember that it will be submitted in the record in its entirety. Any summary or presentation of those comments that you would like to make in opening the hearing, the committee would be glad to receive.

Mr. Del Balzo?

STATEMENT OF JOSEPH M. DEL BALZO, EXECUTIVE DIRECTOR FOR SYSTEM DEVELOPMENT, FEDERAL AVIATION ADMINISTRATION; ACCOMPANIED BY: MARTIN POZESKY, ASSOCIATE ADMINISTRATOR FOR SYSTEM ENGINEERING AND DEVELOPMENT, FEDERAL AVIATION ADMINISTRATION, AND DALE MC DANIEL, DEPUTY ASSOCIATE ADMINISTRATOR FOR POLICY, PLANNING AND INTERNATIONAL AVIATION, FEDERAL AVIATION ADMINISTRATION

Mr. Del Balzo. Mr. Chairman, thank you very much.

It goes without saying that I am very pleased to be back again to give you an overview of the FAA's Research and Development Program.

There is no question, as you know, that this subcommittee has provided strong support to our research program over the years. We certainly appreciate the chance to discuss the progress we have made as well as the plans for the future.

With your agreement, I would like to submit a more detailed statement for the record, and take the time just to highlight some of the more important issues that we have addressed in the statement.

Mr. Torricelli. Mr. Del Balzo, without objection, each member of the panel's testimony will be entered into the record in its entirety.

Mr. Del Balzo. Thank you.

Before I talk about the fiscal year 1991 budget request, I think it is important to just digress for just a minute to tell you about a recent realignment within FAA that I believe will have a very positive effect on our research, engineering and development program.

Not too long ago—February 21—Admiral Busey announced this realignment, which I think will significantly impact the engineering community. The new Executive Director for Acquisition has been set up to streamline the acquisition process and to ensure the overall program management of major systems is improved.

When one looks at what has happened in FAA over the past 10 years, we have seen a capital investment budget increase from $250 million a year, to what is now $2.5 billion, to $3 billion a year in order of magnitude. No question that we have now entered into the big leagues of system development, and if you want to play in the big leagues you need a big league organization, we need a big league capability. I think that is what we have now put in place.

The big league capability means a system engineering organization that must do a better job of interfacing the research and development projects of the National Aerospace System. The need to look at the fast track type procurement strategies to get these products into the field in the short term, not the long term. We spend too much time in getting RE&D products implemented. We need to do it better; we need to do it faster.

The good news is that we have some exciting research and development programs which we want to assure get to the field in the shortest possible time.

For fiscal year 1991, we are requesting $190 million to support the RE&D program. This amounts to about a 12 to 13 percent increase—$20 million for the current fiscal year. We have analyzed

RE&D programs in the development to provide a balance between near term, rapid development activities and long term research to meet the aviation needs of the 21st century.

This increased spending level is in response to the growing demands of the aviation community and to the requirements of the Aviation Safety Research Act of 1988.

Some of the new and expanded initiatives in the program, the National Simulation Laboratory, that will allow us to investigate the relationships between elements of the National Aerospace System and capacity enhancements from our capital investments over the long term, and to also test and demonstrate the new technology of the air traffic control system of the 21st century, new automated traffic control aids for the terminal environment, research on the related human factors issues of control of pilot integration, and to the automated environment of the future.

Additional highlights include development of an explosive detection laboratory to test and demonstrate technology, to expedite field testing of promising developments, application of NASA/DOS research on metal fatigue, corrosion, and composite material properties, and finally, the integration of severe weather detection capabilities into the National Aviation System.

When we look at the 1991 budget request as part of our reauthorization bill submitted to Congress on March 19, we are proposing increases over current level funding for our RD&E programs.

As you know, a significant, but now declining, portion of the RD&E budget supports implementation of our capital investment program. More and more an increasing share will be devoted to countering the threat of terrorism, improving safety, and laying the foundation for the next generation of air traffic control equipment. For fiscal years beginning after September 30, 1990, we are requesting aggregate amounts not to exceed $190 million in 1991, $385 million for fiscal year 1992, $580 million in 1993, leveling out, finally, in 1995 at a level of $970 million.

The strength of the RE&D program lies in its long-term approach to defining problems and working with the aviation community to find solutions to those problems. Federal Government FAA doesn't have all the answers. Industry involvement and cooperation are important sources of input at every stage of the process. The FAA is committed to increasing the involvement of the aviation community. I would say that more than 400 members of the aviation community attended the December 1989 R&D conference in Washington, which sought to use their input on ways to improve the agency's R&D plan.

R&D is the foundation of our world preeminence in aviation. Continued commitment to a long-term R&D program is a crucial component of the U.S. aviation success story. It will be even more vital in the decades to come.

We are approaching the end of the NAS Plan which charted the procurement and installation of major equipment systems over a 10 year period. That plan is now well on its way to full implementation. First deliveries have been made of more than 80 percent of NAS Plan projects. We are now at a crossroads in committing ourselves to developing systems and equipment that will extend our leadership in world aviation well into the 21st century.

This committee has made significant contributions to the direction of the RE&E program over the years, most recently with the passage of the Aviation Safety Research Act of 1988. I am pleased to say the FAA has moved ahead in many areas this legislation addressed.

One provision of the Act that has had an important impact is the establishment of the RE&d Advisory Committee, a 20- member group to advise the Administrator on the focus and direction of the RE&E program. You will hear from the chairman of that committee later on this morning.

When we look at the role of that committee, it was certainly instrumental in restructuring the contents of our annual research and development plan. We are now looking forward to their input on our national plan for aviation human factors research and a system design for the turn of the century that we are currently developing in conjunction with our capital improvement program.

Let me quickly just review some of our achievements for 1989. When we testified before this committee a year ago, we said fiscal year 1989 would be the year of putting in place a plan, fiscal year 1990 and 1991 would be the years of putting in place the capability to carry out that plan.

I think we have fulfilled that commitment in fiscal year 1989 with the help of the advisory committee and the aviation industry. We did, in fact, put an R&D program into place with aviation community support.

But I think we went beyond that in fiscal year 1989. We actually achieved some significant accomplishments. In response to aircraft aging issues, and with Congressional direction from the Research Act, we initiated an aging aircraft research program, a multi-year effort to identify current and future needs of the aging U.S. air transport fleet.

The new Denver airport will be the first addition to the U.S. system of major airports since 1974. We moved ahead in developing components for terminal ATC automation, a system to improve airport capacity and increase the efficiency of flight operations in all weather conditions.

We have completed airport capacity task forces at Memphis, Phoenix, St. Louis, Miami, and Kansas City. We have drawn together airport management, local FAA officials, airlines, commuters, industry groups, and airport consultants to investigate ways to improve airport capacity and reduce delays.

We used an R&D simulation model to analyze the airspace around traffic control centers in Boston, Dallas, Fort Worth, Denver and Chicago, and we have made that model now available to the public in 1989, and it has becomes a valuable tool to airport planners.

We installed two prototype high update radar systems, one at Raleigh/Durham airport and another at Memphis, to monitor approaches to the closely space parallel runways. When they are fully operational, those radars have the potential to increase the capacity of airports by up to 30 percent.

We ordered a contract for production of six explosive detection systems based on thermal neutron analysis x-ray technology. The first system became operational at Kennedy Airport in 1989.

The most promising advances in 1989 were in the development and evaluation of data link services—sponsors of the symposium in 1989 to promote the increased understanding of the use of data link. We are determined to improve environmental quality while meeting the demands of interstate commerce. We committed ourselves to leading the national debate on the noise issue through a public process that will include all the affected parties, the industry and community groups, Federal, State and local governments as well as the general public.

This process will build on a history of Federal leadership in advancing significant progress in aviation noise abatement. In 1970 there were an estimated seven million people in the United States who were affected by aviation noise. Over the course of the past two decades, that number has shrunk to 3.2 million despite significant increases in air traffic. By the year 2010, we think we can reduce that number further to one million. That is a dramatic reduction in the number of people affected by aviation noise. That reduction has resulted almost exclusively from the introduction of quieter aircraft. Progress in protecting land areas around airports has not kept pace. FAA and NASA together are exploring the development of additional noise abatement engine technology, but the truth is that we do not expect further dramatic reduction at the source, it has to be a different way to solve the noise issue.

The research and development achievements for 1989 are the results of past investments of financial and human resources. In many cases the achievements have cost years of efforts, and in some cases, the product is still in the future. The true challenge of the R&D program is maintaining the long-term commitment and the long-term prospective that make technological progress possible. With this committee's help, we will do just that.

We have in place right now an infrastructure in which to build a complex of systems that combines elements from each of the seven research areas. We are beginning to see significant results.

Mr. Chairman, that concludes my prepared statement. My colleagues and I will be glad to answer any questions from the subcommittee.

[The prepared statement of Mr. Del Balzo follows:]

STATEMENT OF JOSEPH M. DEL BALZO, EXECUTIVE DIRECTOR FOR SYSTEM DEVELOPMENT, FEDERAL AVIATION ADMINISTRATION, BEFORE THE HOUSE COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY, SUBCOMMITTEE ON TRANSPORTATION, AVIATION, AND MATERIALS, CONCERNING THE FAA'S RESEARCH, ENGINEERING, AND DEVELOPMENT PROGRAMS. APRIL 26, 1990

Mr. Chairman and Members of the Subcommittee:

I am pleased to be here today to give you an overview of the FAA's Research, Engineering & Development (R,E&D) Program. This Subcommittee has provided strong support to our R,E&D Program over the years and we appreciate the chance to discuss the progress we have made as well as our plans for the future. Accompanying me today are Marty Pozesky, Associate Administrator for System Engineering and Development, and Dale McDaniel, Deputy Assistant Administrator for Policy, Planning, and International Aviation.

The aviation industry has changed significantly since the passage of the Airline Deregulation Act in 1978. We have seen a highly regulated system of routes and fares give way to a flexible, market-driven system that has benefitted air travelers substantially, and we have experienced major reductions in aviation accident rates and fatalities. As we look to the 1990s, we need to anticipate--not react to--the demands and impacts of continued aviation growth. The R,E&D Program is the core of the FAA's efforts to meet the challenges that lie ahead.

Before I address our FY 1991 budget request, let me digress for a moment to tell you about a recent realignment within FAA that I believe will have a very positive effect on our R&D Program. On February 21, Admiral Busey announced his realignment, which will significantly impact the engineering community. A new Executive Director for Acquisition has been set up to streamline the acquisition process and to ensure that the overall program management of major systems is improved. My people are working with this new organization to reduce the amount of time it takes to get a project into the field. The restructuring will bring a new (and exciting) way of doing business associated with the management of programs--MATRIX management. Under this concept, the role of FAA program managers will be greatly enhanced. Our program managers will be reporting at higher levels and given the resources from other MATRIX organizations to get their jobs done. Our program manager can now count on his lawyer, procurement specialist, and national airspace integrated logistics (NAILS) specialist to help him in getting his program implemented.

As of now, we have established 24 separate program offices which will be charged with conduct of National Airspace System Plan (NAS Plan) activities. I have simplified the reporting structure within the organizations to ensure that those program managers have easy access to the decision makers when they need help. We're very excited that this new method of program management will result in getting improved Facilities and Equipment (F&E) products into the field in a short period of time.

In addition, I have charged the System Engineering Organization to do a better job of interfacing the R,E&D projects into the National Airspace System (NAS). They will be looking at fast-track type procurement strategies to get our R,E&D products into the field in the short term. We have been spending entirely too much time in getting our R,E&D products implemented. We have some exciting R,E&D programs which I want to ensure get to the field in the shortest timeframe possible.

Finally, in this restructuring, the Administrator set up a focal point for new Facilities requirements. With the advent of area control facilities (ACFs), the Metroplex Control Facility (MCF), terminal Los Angeles basin service (T-LABS), and our New Denver Airport project, I felt it was important to ensure that facilities planning and systems engineering were fully coordinated. I expect this new Facilities Engineering Service to go a long way toward ensuring that our new facilities construction projects are fully consistent with our long-range consolidation plans.

By the way, in early May this new realignment will be totally in place. I am very proud of the fact that we were able to accomplish this restructuring in a little over two months.

For FY 1991, $190 million is requested to support the R,E&D program. This is approximately a 12-percent increase ($20 million) over the current fiscal year. A revitalized R,E&D program is under development to provide a balance between near-term, rapid-development activities, and long-term research to meet the aviation needs of the 21st century. The increased spending level is in response to the growing demands of the aviation community and to the requirements of the Aviation Safety Research Act of 1988.

New and expanded initiatives in program areas are: a National Simulation Laboratory that will enable us to investigate the relationships between elements of the NAS and capacity enhancements from our capital investments over the long term, as well as to test and demonstrate technology for the air traffic control system of the 21st century; new automated air traffic control aids for the terminal environment and research on the related human factors issue of controller/pilot integration into the automated environment of the future; development of an Explosive Detection Laboratory to test and demonstrate technology to detect new and exotic explosives and to expedite field testing of promising developments; application of NASA/DOD research on metal fatigue, corrosion, and composite material properties to better detect defects in aging aircraft; and the integration of severe weather detection capabilities into the NAS.

In addition to our FY 1991 budget request, as part of our reauthorization bill submitted to the Congress on March 19, we are proposing increases over current level funding for our R,E&D programs. As you know, a significant but now declining portion of the R,E&D budget will support implementation of the NAS Plan, but an increasing share will be devoted to countering the threat of terrorism, improving safety, and laying the foundation for the next generation of air traffic control equipment. For fiscal years beginning after September 30, 1990, we are requesting aggregate amounts not to exceed $190 million for FY 1991,

$385 million for FY 1992, $580 million for FY 1993, $775 million for FY 1994, and $970 million for FY 1995.

The strength of the R,E&D Program lies in its long-term approach to defining problems and working with the aviation community to find solutions to those problems. Identifying promising technologies is only a beginning. Systems and equipment undergo years of prototype development, testing, modification, and retesting before they are judged ready for implementation. Industry involvement and cooperation are important sources of input at every stage of the process, and the FAA is committed to increasing the involvement of the aviation community. More than 400 members of the aviation community attended the December 1989 R,E&D Conference in Washington, D.C., which sought user input on ways to improve the agency's R,E&D Plan.

R,E&D has been the foundation of our world preeminence in aviation. Continued commitment to a long-term R,E&D program is a crucial component of the U.S. aviation success story, and it will be even more vital in the decade to come.

The FAA is approaching the end of the NAS Plan, which charted the procurement and installation of major equipment systems over a

10-year period. The NAS Plan is well on its way to full implementation--first deliveries have been made of more than 80 percent of NAS Plan projects. Now we're at a crossroads in committing ourselves to developing systems and equipment that will extend our leadership in world aviation well into the 21st century.

This Committee has made significant contributions to the direction of the R,E&D Program over the years, most recently with the passage of the Aviation Safety Research Act of 1988. I am pleased to say that the FAA has moved ahead in many of the areas this legislation addressed.

One provision of the Act that has had an important impact is the establishment of the R,E&D Advisory Committee, a 20-member group to advise the Administrator on the focus and direction of the RE&D program. The Committee held its first meeting in May 1989 and has worked actively and cooperatively with FAA officials.

The Advisory Committee formed seven subcommittees on aviation medicine and human performance, R&D project review, the R,E&D process, system capacity, tiltrotor technology, transport aircraft safety, and the National Simulation Laboratory. The

R,E&D Process Subcommittee reviewed how FAA conducts R&D and provided valuable input to the organizational restructuring I have already discussed. Members of the Advisory Committee were also instrumental in restructuring the contents of the annual RE&D Plan into seven major research areas: aircraft safety technology; capacity and air traffic control technology; system security technology; human factors; atmospheric environment; communications, navigation, and surveillance; and airport improvement. We look forward to reviews of our National Plan for Aviation Human Factors Research and a System Design for the turn of the century that FAA is currently developing in conjunction with our Capital Improvement Plan.

I would like to review for you some of our FY 1989 achievements in each of the seven research areas.

AIRCRAFT SAFETY TECHNOLOGY

The standards developed as a result of aircraft safety research have made U.S. aircraft the safest mode of modern transportation. Research in safety technology affects all stages of the aircraft life cycle, from the development of designs and materials for the aircraft of the future to high priority research on the special maintenance requirements of the aging U.S. aircraft fleet.

Rapid growth in U.S. air carrier passenger traffic during the 1980s, coupled with the long waiting list for new airplanes, has meant operating aircraft beyond the economic life originally planned. As a result, the average age of the U.S. commercial air fleet rose from 4.6 years in 1970 to 12.1 years in 1988. In response to aging aircraft issues and with Congressional direction from the Aviation Safety Research Act of 1988, the FAA initiated the National Aging Aircraft Research Program, a multiyear effort to identify current and future needs of the aging U.S. transport fleet. The program plan, drafted in cooperation with industry and other government agencies, focuses on near-term elements to define the extent of the problem and to explore issues relating to fatigue/multiple-site cracking, corrosion, nondestructive inspection, and human factors. Longer-term issues the program will address include "cradle-to-grave" structural integrity plans, and new onboard systems for monitoring structural fatigue and detecting corrosion.

Over the past two decades, the majority of aviation fatalities for U.S. carriers have been caused by post-crash fires. The purpose of fire safety R,E&D is to develop ways to minimize the likelihood of aircraft fires and to improve the chances for survival when fire does occur.

As for new research activity, the FAA has undertaken a cooperative effort with the United Kingdom Civil Aviation Authority and Transport Canada to determine the feasibility of an onboard water-spray system. During FY 1989 the FAA tested a British-provided cabin water-spray system in a narrow body aircraft fuselage, with promising results. Ongoing R,E&D will examine practical considerations associated with such an onboard system, including reducing the weight of the system to an acceptable level.

CAPACITY AND ATC TECHNOLOGY

Forecasts released by the FAA in February 1990 point to continued expansion of aviation activity. This increased aviation activity is the driving force of long-term research on capacity and air traffic control (ATC) technology.

While the image of crowded skies is a mistaken one, congestion around major airports is a challenge we must confront. The new Denver airport will be the first addition to the U.S. system of major airports since the construction of Dallas/ Fort Worth

International Airport in 1974. In the coming decade, we will need new concepts and technologies to enable us to use the airspace around existing airports more efficiently to relieve congestion and reduce delays.

During FY 1989 the FAA moved ahead in developing components of Terminal ATC Automation (TATCA), a system to improve airport capacity and increase the efficiency of flight operations in all weather conditions. When it is fully implemented, TATCA will automate many planning functions now performed by controllers. During 1989 the agency developed and demonstrated a laboratory prototype of a controller display aid for simultaneous converging approaches. The final approach spacing aid will allow controllers to route two arrival streams of traffic under instrument meteorological conditions at airports with converging or intersecting runways. Preliminary results of studies by the FAA, other government agencies, and foreign organizations indicate that arrival planning techniques may be able to increase terminal capacity by 15 to 28 percent.

The FAA completed airport capacity task force studies at Memphis, Phoenix, St. Louis, Miami, and Kansas City this year. The task forces bring together airport management, local FAA officials, airlines, commuters, industry groups, and airport consultants to investigate ways to improve airport capacity and reduce delays. As a direct result of task force efforts, new runways are being planned at Atlanta, Detroit, Kansas City, Phoenix, Seattle, and St. Louis. The 1989 task forces made more than 175 recommendations, 20 of which have been implemented, with potential delay reductions estimated at more than 70,000 hours.

Several projects in capacity research use computer simulations to explore ways to expand capacity without disrupting the day-to-day operation of the NAS. The FAA used the R&D-developed Simulation Model Development and Validation (SIMMOD) in analyses of the airspace around air route traffic control centers in Boston, Dallas/Fort Worth, Denver, and Chicago during FY 1989, and in an airspace design study of the terminal airspace in the Los Angeles Basin. A microcomputer version of SIMMOD was made available to the public in 1989 and it will be a valuable tool for airport planners.

The Performance Analysis Capability model (NASPAC) is being used to study the impact on the NAS of the Dallas/Fort Worth Metroplex, the new Denver airport, and changes in southern California airspace. NASPAC gives decision makers and strategic planners information on how changes in local airspace design and management affect the National Airspace System as a whole.

The FAA installed two prototype high-update radar systems, one at Raleigh-Durham Airport and another at Memphis, to monitor approaches to closely spaced parallel runways. The two types of equipment--E-Scan at Raleigh-Durham and Mode S with back-to-back antennas at Memphis--will give controllers more frequent position updates than does conventional radar and will enable airports to use closely spaced runways during bad weather. When they are fully operational, the radars have the potential to increase the capacity of airports with closely spaced runways by up to 30 percent.

The synthetic vision project is a government/industry effort, based on Air Force and NASA research. Infrared and millimeter-wave technology that will provide pilots with a precise visual representation or "picture" of the runway during approaches and landings in poor visibility. The FAA is moving ahead on this project, which will enable pilots to land under instrument meteorological conditions with less reliance on ground-based aids.

United and Northwest Airlines evaluated the Traffic Alert and Collision Avoidance System II (TCAS II) in limited installation programs during 1989. TCAS will enable pilots to identify their position relative to other aircraft, without controller input. More advanced versions of TCAS will provide advisories to the pilot on avoidance maneuvers if surrounding aircraft come too close. TCAS II will be required in all civil aircraft with more than 30 passenger seats operating in the United States by the end of 1993.

SYSTEM SECURITY TECHNOLOGY

The threat of international terrorism makes it imperative that the FAA continue its development of advanced technologies for security systems. Protection must be comprehensive, addressing vulnerabilities in airports and in air traffic control facilities, as well as on board aircraft.

In August 1988 the FAA awarded a contract for production of six explosive detection systems based on thermal neutron analysis (TNA)/X-ray technology. The TNA and X-ray systems will act together as a "dual-sensor" system, with data from each being correlated by a single controlling computer. The system has a demonstrated detection rate of 95 percent. The first TNA/X-ray system became operational at John F. Kennedy International Airport in September 1989, and the remaining five systems will be installed at domestic "Category X" airports and overseas during 1990. Each system will undergo full-scale operational testing for at least 1 year.

The TNA system is a good start at providing effective detection of explosives in baggage. An active new technology effort aimed at developing cost-effective, faster, and more efficient explosive detection systems is underway. Two prototype detectors, based on biotechnology and nuclear interrogation, respectively, have shown initial promise and will be pursued further in 1991.

The FAA developed a design and implementation plan for the enhanced security demonstration project at Baltimore Washington International Airport. The design is the result of coordinated efforts of the airport operator, air carriers, law enforcement officials, and the FAA. The basic concept of the system is to create a "sterile exclusion area". All passengers, employees, and materials will be screened before entering the area, and sensors will detect intruders at unauthorized entry points. The demonstration will evaluate the costs and benefits, both operational and economic, of comprehensive security systems.

A prototype vapor portal system for screening passengers was tested at Boston's Logan Airport during 1989. The tests showed that further development of the system's speed and sensitivity was needed, and it will be retested at an airport in 1990.

HUMAN FACTORS

Despite continuing automation of many aspects of air-traffic control and flight, in the final analysis the safety of the system depends on the knowledge and skills of the people, the "human factor". Of particular concern is the changing nature of the aviation work force and its implications for system design, training, and operations. Research on human factors can provide information that is immediately useful in designing systems and programs that are attuned to the needs of the men and women who operate them.

As a result of the Aviation Safety Research Act of 1988, the FAA has substantially expanded its program on human factors and their relationship to aviation safety. The agency has appointed a nationally-known human factors professional as the FAA's Chief

Scientific and Technical Advisor for Human Factors to spearhead agency efforts in human factors research, and has issued a broad agency announcement in the Commerce Business Daily to solicit long-term human factors research proposals.

The FAA has made a commitment to manage and coordinate the development of a National Plan for Aviation Human Factors Research, which will organize into a single comprehensive plan the work of human factors "centers of excellence" in the FAA and other government agencies. The agency has also established an internal Human Factors Coordinating Committee (HFCC) that reports to the four Executive Directors of the FAA. Subcommittees of the HFCC will develop and oversee plans for human factors initiatives within the directorates.

During 1989 the FAA sponsored a conference on human factors in aviation maintenance and inspection and developed an outline of research topics. Research in this area is expected to yield important results that will complement related projects on aging aircraft systems and materials.

FAA's Human Factors research programs are only the tip of the iceberg with regard to the agency's human factors efforts.

Virtually every research effort that touches on the interfaces with pilots and air traffic controllers examines the human factors implications of the man/machine design. This provides us with an effective means of applying the results of human factors research to the aviation system of tomorrow.

ATMOSPHERIC ENVIRONMENT

Weather is a critical factor in all flight operations, and systems to improve weather forecasting, detection, and dissemination of weather information have an important role to play in maintaining the safety and capacity of the NAS. R,E&D on the atmospheric environment includes efforts to improve the accuracy of weather information and to make the information available to users of the aviation system in a timely manner.

Windshear is a sudden change in wind speed and direction that poses a serious threat to aircraft landing at or taking off from an airport. The Low-Level Windshear Alert System (LLWAS) monitors winds in the immediate vicinity of the airport and alerts the controller when dangerous windshear conditions are detected. During 1989 the agency developed requirements for an ice-free sensor for LLWAS that will enhance the all-weather reliability of existing LLWAS systems. The FAA also tested LLWAS integration with Terminal Doppler Weather Radar (TDWR) at Denver's Stapleton Airport. Linking LLWAS and TDWR will provide a single, highly effective system with a common display to provide terminal wind-hazard information to controllers. The agency is also looking at the potential for development of a cost-effective airborne capability that would augment these systems, especially where TDWR is not available.

The FAA demonstrated TDWR's ability to detect microbursts and gust fronts for air traffic controllers at Kansas City International and Denver Stapleton Airports.

The FAA demonstrated the Real-time Weather Processor (RWP) interface with simulated Next Generation Weather Radar (NEXRAD). The FAA has joined with the National Weather Service and the U.S. Air Force Air Weather Service in a program designed to develop and deploy the NEXRAD system, a surveillance radar designed for wide-range coverage. NEXRAD weather information will be sent automatically to the RWP, which will merge data from several radars and other sources to create a mosaic of the area weather. When fully implemented, the RWP will be the key system in the NAS for distributing real-time weather information to pilots and controllers.

COMMUNICATIONS, NAVIGATION, AND SURVEILLANCE

The goal of research in communications, navigation, and surveillance (C/N/S) is to develop high-quality services and make them available anywhere on the surface of the earth.

The most promising advances in 1989 are in the development and evaluation of data link services. Data link is the direct transfer of information between ground-based or satellite-based services and individual aircraft. The first annual Data Link Symposium was sponsored by the FAA in June 1989 to promote an increased understanding of data link in the aviation community.

The FAA performed an operational evaluation at the FAA Technical Center of the initial air traffic control data link services. Results indicate that data link can increase safety, capacity, and efficiency by minimizing the number of messages that must be relayed from controllers to pilots, thereby reducing the ATC workload and minimizing possible information transfer errors.

The Pre-Departure Clearance demonstration system was installed at Dallas/Fort Worth and Chicago International Airports, and we are adding a third demonstration site at San Francisco International

Airport. The system uses data link to deliver departure clearances directly from the control tower to aircraft. The participating airlines are very enthusiastic about the capability, which has reduced traffic on the voice channel by at least 50 percent. We are moving to expand the capability to other sites with a combination of FAA and private-sector resources as soon as possible.

Satellite C/N/S systems are especially attractive for airspace where ground-based coverage is ineffective (low altitudes), nonexistent (many undeveloped nations), or unfeasible (oceanic airspace).

A satellite link will provide Automatic Dependent Surveillance (ADS) position reports on oceanic flights directly from the onboard navigation equipment of the aircraft to controllers. Present systems, with controllers monitoring flight progress based on periodic position reports from flight crews, cannot provide the timely information needed to achieve optimal separation of aircraft on oceanic routes. This has led to rigid route structures and overly large separations of aircraft on these routes. ADS will allow aircraft separations in oceanic routes to be reduced by as much as 50 percent, allowing more efficient flight paths. Memorandums of understanding and bilateral agreements have been signed or initiated with several international ADS participants, including Japan, the United Kingdom, Canada, Iceland, and Portugal. A Memorandum of Agreement was signed with Northwest Airlines to furnish ADS reports for pre-operational trials.

AIRPORT IMPROVEMENT

Airport improvement projects address physical and environmental aspects of airports, including airport safety; pavement strength, durability, and repair; and airport design and planning.

Runway lighting systems are an important airport safety feature. Research in lighting systems will produce devices that improve daytime and nighttime visibility and provide guidance information for use under low-visibility conditions. During 1989 the FAA installed a hold-short lighting system for evaluation at Boston's Logan Airport, and developed and tested enhanced low-visibility taxiway intersection markings and edge lights.

The FAA is also active in improving the firefighting and rescue services at airports. Research is ongoing at the FAA's Technical Center on fire extinguishing agents and on the characteristics of new aircraft materials that require special firefighting procedures and equipment.

Repair and maintenance of airport pavement is an important cost and safety consideration. FAA pavement studies test the durability and ease of repair of new materials, evaluate innovative repair and construction techniques to minimize runway downtime, and develop criteria for quality control and pavement specifications.

Airport design and planning focuses on heliport/vertiport designs that will help integrate helicopters and tiltrotors into the NAS, with attendant capacity gains. An analysis of heliport accidents was initiated in FY 1989 and will continue through 1991. The results will be used to determine whether the accidents point to a need for changes in design criteria.

Other airport design efforts are aimed at developing a microcomputer-based simulation package for architects, engineers, and analysts who design airport terminal buildings. The simulations will be used to expand and improve existing terminals, design new terminals, and evaluate cost-effective management strategies.

NATIONAL TRANSPORTATION POLICY AND AVIATION NOISE

The President's National Transportation Policy provides a clear overview of the impact of aircraft noise on the growth of aviation and commits the Federal Government to providing the leadership necessary to develop appropriate solutions. The Department of Transportation is determined to improve environmental quality while meeting the demands of interstate commerce. The FAA is committed to leading a national debate on the noise issue through a public process that will include all affected parties--industry and community groups; Federal, State, and local governments; as well as the general public.

This process will build on a history of Federal leadership in advancing significant progress in aviation noise abatement. In 1970, there were an estimated 7 million people in the United States who were affected by aviation noise. Over the course of the past two decades, the number of noise-impacted people has shrunk to about 3.2 million, despite significant increases in air traffic. The FAA believes this number will be reduced to 1 million by the year 2010.

This dramatic reduction in the number of people affected by aviation noise has resulted almost exclusively from the introduction of quieter aircraft; progress in protecting land areas around airports has not kept pace. FAA and NASA are exploring the development of additional noise abatement engine technology, but we do not expect further dramatic reductions of noise at the source.

CONCLUSION

The R,E&D achievements for 1989 are the result of past investments of financial and human resources. In many cases, the achievements have cost years of effort and in some cases the final product is still in the future. The true challenge of the R,E&D Program is maintaining the long-term commitment and the long-term perspective that make technological progress possible.

We have in place an infrastructure on which to build--a complex of systems that combines elements from each of the seven research areas mentioned above--and we are beginning to see significant results. There are challenges remaining, however, that depend on our continued commitment in each of the seven areas.

- The FAA commitment to safe aircraft requires ongoing development of improved systems and materials.

- Capacity issues will continue to demand attention in the decade to come: technology to expand airport and airspace capacity utilization is a vital need.

- Although the United States has been spared much of the global terrorist activity, advanced security systems to thwart such actions cannot be considered a luxury item.

- In human factors research we face the pressing need to integrate human system engineering into the development programs that will shape the systems and the work force of the future.

- Improved weather forecasting and detection technology is necessary to improve the safety of aircraft in all weather conditions and improve utilization of airspace and airport capacity in all weather conditions.

- Cost-effective communications, navigation, and surveillance services must be available around the clock and around the world.
- Existing airports and the airports of the future must have access to the most advanced materials, equipment, and technologies to ensure the safety and convenience of the flying public.

My remarks describe the results of decades of progress and the hopes for future advances. The FAA is prepared to continue its efforts to maintain U.S. leadership in aviation, and we look forward to the continued support of this Subcommittee in our efforts to do so.

This concludes my prepared statement, Mr. Chairman. My colleagues and I would be pleased to respond to any questions from the Subcommittee at this time.

Mr. Torricelli. Thank you, Mr. Del Balzo.

Mr. McDaniel, Mr. Pozesky, did you want to offer any comments before we proceed.

Mr. Pozesky. No, I do not have a statement.

Mr. McDaniel. No.

Mr. Torricelli. Thank you, and thank you, Mr. Del Balzo, for your comments this morning.

Could you give us some analysis of the difference between the $245 million research request that was made and the $190 million recommendation that the Congress has received. What costs are involved in the reduction?

Mr. Del Balzo. What you will find the difference to be is not in areas that we are not doing research, but rather in the pacing of the research. A $190 million request touches on the critical areas of research that we must address.

With the additional funding between $190 and $240 million, my guess is that we could accelerate several of the programs by one to two years. What we have done it—

Mr. Torricelli. There is no area of research from aging aircraft to noise to control operations that research will not be done this year that otherwise would have been done?

Mr. Del Balzo. I don't believe that is true. I would ask Mr. Pozesky for more details, but I think the answers is no.

Mr. Pozesky. Mr. Chairman, in a general sense the answer to that is no. We are doing research in those areas. When you get to another level of detail below that, and you ask how extensive is that work being done, are you examining all the options associated with a particular area, you will find that in some cases we've had to truncate some of the options that we were examining in association with some of those areas in order to put our priority on the most promising alternatives.

Mr. Torricelli. So quantify for me if you could, in the areas of great public concern today in aging aircraft and the improvements in the control system in the country. Are there any levels that you can quantify the cost, in terms of research and the time the development of improvements that are being lost?

Mr. Del Balzo. I think that would be very difficult to do. We have not attempted to do that. When we look at a funding profile, we try to maximize the impact of the dollars that are available in terms of our best judgement of priorities. In terms of quantifying that impact, we have not done that.

Mr. Torricelli. Well, just develope it a stage further. In the aging aircraft and fuselage questions, when is it that you were hoping to have some more definitive understanding of the wear in the fuselage of aircraft, a better understanding of parameters of what should be permissable in aging aircraft that you had hoped and what you would now expect.

Mr. Del Balzo. In aging aircraft area, we had hoped to have some definitive results within 12 to 24 months. That program has not been impacted by a budget reduction.

The kind of reductions that we would take in the aging aircraft program would be the exploration of new technology regarding the examination of a whole airplane. One of the concepts that we find extremely attractive is to treat and examine an aircraft the way we treat and examine human bodies today. The ideal solution would be to have a national capability equivalent to a CAT scan of the human body, so it is that kind of technology that we would put off until fiscal year 1992 and fiscal year 1993, but in terms of the impact of real time data collection to give us a better handle on corrosion—

Mr. TORRICELLI. That part of it is not impacted?

Mr. DEL BALZO. That part of the program is not impacted.

Mr. TORRICELLI. But the diagnostic research goals is impacted.

Mr. DEL BALZO. Exactly.

Mr. TORRICELLI. We received testimony on Tuesday concerning the potential inadequacy of the LDN noise calculation, and there was some discussion of the possible desirability of seeking an alternate method of calculating noise impacts, that would be useful both for the industry's purposes but also understandable by the public, to give us a greater understanding of the comparability of aircraft noise, and of course, its calibration.

Could you comment on the advisability of keeping an alternate scale?

Mr. MCDANIEL. We think, Mr. Chairman, that probably the LDN scale is the best scale that exists in relationship to the data, which is a considerable amount of data, supporting the measurement method. Any noise measurement method, to some degree, is dependent upon the subjective response of persons living around the airport, so there will not be an exact correlation between the noise measurement and how human beings respond, but the LDN scale does the best of all the scales in fitting the scientific data to what community response is. The parameters set out by the Aviation Noise and Safety Act of 1979, which called for the creation of a single measure, is really met by the LDN. We are not aware of any additional scientific evidence which would suggest that a new measure would be improved. We are open to looking at scientific evidence. Indeed, we are continuing to look at supplementary measures. We are working now with the EPA to look to see if there are pockets within LDN which are not adequately captured by the LDN measure. We are continuing to look at community response in relationship to noise events, so we are continuing to seek the best way, but we think, for the time being, the LDN measure is the best one.

Mr. TORRICELLI. Don't you sense some inability of the public to grasp the measurement. As I see your personnel at hearings around the country dealing with the public, it would not appear to me the public begins to be able to quantify aircraft noise alternatives by using LDN.

Mr. MCDANIEL. It is a difficult measure to grasp. For one thing, noise is measured on a logarithmic scale so that every 10 db increase in noise is actually a doubling of noise. That is difficult for many people to grasp, and then the LDN measure is an accumulated noise measure over a period of time, which is a little difficult for people to relate to.

Mr. TORRICELLI. Isn't, by definition, a measurement that is successful and appropriate, as you have defined LDN, one that also is usable and graspable by the public?

Mr. McDaniel. It should certainly relate to how people respond to noise, which LDN does, but we also agree that it should be more easily understood. One of the activities we have going on now is an attempt to translate what LDN means to a lay person that will be living around the airport, so that we can have some perception what this thing means.

We have created during the past year what we call an interactive sound information system, or ISIS, which allows the hearer to hear noise events relative to each other, so they can hear common noise events—lawn mower, truck going by, something of this nature—as well as aircraft which meet various stages of noise standard, so that there is an audible measure of, "what difference does it make anyway about the size of the aircraft, the type of the aircraft, its noise characteristics relative to where do I live around the airport and how does that affect me."

We are hoping to build on that in a way which allows people to translate that into an LDN—

Mr. Torricelli. But what is the product that you envision?

Mr. McDaniel. The product will be both an explanatory brochure as well as, we hope, something which is an audio visual characterization of what differences in noise levels mean. We find that hearing it is much different than talking about db 65 or 85 db. If you can hear the difference between those two, it really means something to you as the hearer.

Mr. Torricelli. The $1.6 million that is proposed for developing and enhancing computer noise models, is that the sum total of current FAA research efforts with regard to noise?

Mr. McDaniel. That is the sum total of the research efforts that we have. Those are directed primarily at community understanding, at models that portray noise and allow you to make policy decisions.

We are additionally, however, working with NASA and have recently reconstituted a memorandum of understanding with NASA. One of the major terms and focus of that will be research on noise at the noise source, which has to do with engines and airframes.

Mr. Torricelli. And where does that appear in the budget request?

Mr. McDaniel. That would appear in NASA's budget request, because they, over the next two years, will be committing something on the order of 40 thousand technical hours to technical research in those areas.

Mr. Torricelli. But there is no corresponding interest in the FAA, and also contributing dollars to that effort, or is there intention to contribute personnel or other scientific assets?

Mr. McDaniel. We contribute our knowledge. We work with NASA to help to shape their program. We are also working with the Air Force in a variety of their activities, as well as the Navy. Wright-Patterson Air Force Base has a very active program measuring community response and alternative insulation and sound proofing measures around airports. We work with them, provide our technical expertise, they provide the resources, and we think that is a very constructive way.

Mr. Torricelli. This is envisioned it primarily as a NASA research effort to which the FAA will lend its experience and whatever personnel is required.

Mr. McDaniel. Yes, sir.

Mr. Torricelli. There was some doubt expressed at our previous hearing on the commercial viability and the economics of a tiltrotor aircraft as having potential for relieving commuter dificulties and airport congestion. Could you comment on that?

Mr. Del Balzo. I think the industry expresses an economic concern. Studies that we have done, there is a second study that is on the way, convinces us that if a tiltrotor technology can be developed that is market responsive it will be economically viable. We believe that tiltrotor technology, for example, can be economically viable in high density markets, less than 300 miles—the northeast corridor is an ideal example. The amount of interest we are now seeing from airlines over the last, I would say 60 days I believe, is significant.

Over the past couple of weeks we have recieved letters from the CEO's and chairmen of four major airlines indicating that there is substantial interest in tiltrotor technology. I think the economic problems go away as the market develops.

Mr. Torricelli. Is the potential market for the aircraft along the size and scale of the V-22?

Mr. Del Balzo. No. I think the major potential from the market studies that are being done, the major potential is going to be in the commuter aircraft business, about passenger capabilities of 19 passengers. The next major market is about 35 passengers, and the third major market is 75 passengers.

Mr. Torricelli. If there were civilian renditions of the V-22 offered, where does that fit in the market?

Mr. Del Balzo. Somewhere between 35 and 75.

Mr. Torricelli. Do you believe that, in either in those that are currently in the business of producing the V-22 for the military or other civilian manufacturers, there is an active interest pending in producing a civilian model?

Mr. Del Balzo. I think the interest is there, certainly in the industry, both in the United States and abroad. The question in the United States is whether or not there will be Federal Funding to help support the development of civil tiltrotor technology.

Mr. Torricelli. Let us take the next stage if, in deed, the Congress did not continue the program and work stops with the prototypes now constructed. What size orders is likely to be required from the civilian aviation industry before it became commercially attractive for a domestic manufacturer to go into production of an aircraft in any one of these scales?

Mr. Del Balzo. An educated guess is between 100 and 300 aircraft. I don't believe that it is a question of whether or not tiltrotor technology finds its way into the civil environment. I think the question today is who is going to build it. Who is going to build it, and who is going to sell it. The Japanese announced about 30 days ago their intention to build a civil version of a tiltrotor—it will be 19 passengers—it will be a tilt-wing, not a tilt rotor. They already have purchased the land for a manufacturing facility in the Dallas-Fort Worth area.

Eurofor, a consortium of European manufacturers. There are five or six European countries who will begin development, full scaled development, in 1994. It will be in the market place before the turn of the century.

There is no question in my mind that a civil version of the tiltrotor will be built and will be sold in the United States. Interestingly enough, the market analyses done by both the Japanese and Eurofor say that 65 percent of the tilt- market is here in the United States. So it may be built somewhere else, and we may loose that leadership, but it will be sold here in the United States.

Mr. TORRICELLI. How long would it now take if the Federal Government remained in the business of producing a military version for a tiltrotor aircraft along the lines of the V-22 to come into the operation for the airline purposes?

Mr. DEL BALZO. We believed a year ago that we could have a civil version of the V-22 certificated by 1995. With the slowdown, we are probably more like 1996. I think that is still doable.

Mr. TORRICELLI. It is still a long time for an aircraft that exists in a prototype stage.

Mr. DEL BALZO. A long time in calendar years, but rather short in terms of how long it takes to bring new technology developed for a Department of Defence requirement into the civil market place. A long time. I don't know what you would say if I tell you that tiltrotor technology has been in the development stage since 1955. That is a long time, you are right, but for that kind of technology, to bring it into the civil marketplace from today, I don't believe that it is that long, sir.

Mr. TORRICELLI. Is it your concept that in our major metropolitan areas that tiltrotor aircraft would be operating off current airports, or that there would be new tiltrotor facilities constructed.

Mr. DEL BALZO. I think it is a combination, again, depending upon the environment and what the market demands are. In the Northeast corridor, I think the heaviest demand will be city center to city center. In the New York area, you are probably talking about verti-ports located along—

Mr. TORRICELLI. The rivers?

Mr. DEL BALZO. The rivers.

Mr. TORRICELLI. So near central cities, you are talking about new facilities.

Mr. DEL BALZO. New facilities.

Mr. TORRICELLI. Could you just describe for me briefly the impact on air traffic control of how it is you would control these aircraft in these route and the impact on either complicating or reducing the current control problems?

Mr. DEL BALZO. Two answers to that question. One, it makes it easier. Two, it makes it harder.

We are working now, we are spending most of our research money in just that area —putting an infrastructure in place that can support the commercially viable tiltrotor operation. What does that mean?

If it's going to be commercially viable in the Northeast Corridor, it will require that you will be able to travel city center to city center in less than 45 minutes. To do that in less than 45 minutes, you have got to be able to handle that vehicle in the airspace differently than you handle conventional airplanes. You need separate routs, separate airspace, separate communications facilities, navigation aids, and surveillance as in air traffic control procedures.

If we can do that, we will have simplified the airspace structure. It will be very easy to introduce it into the system. If we cannot do that, if we have to handle this vehicle as we do other airplanes and mix it in with the rest of the traffic, one, it won't be commercially viable, two, even if it was, I believe it would be much more complicated to fit into the system than it is probably worth. It has got to be handled separately to take advantage of its unique capability.

Mr. TORRICELLI. Do you believe that the potential exists?

Mr. DEL BALZO. Yes sir, I do.

Mr. TORRICELLI. Let me turn your attention to the microwave landing system question for a moment. Could you give me some analysis of its implementation, and walk us through the next few years in implementation plans?

Mr. DEL BALZO. Sure.

Let me put it in context. The microwave landing system is the only technology that I am aware of that can increase capacity, increase safety, and reduce noise. I don't know of any other technology that will provide us those three benefits, because normally benefits like that work against each other. If you are going to increase capacity, you increase noise; if you are going to increase safety, you are going to compromise capacity. Microwave landing system technology gives you increase capacity benefits, it gives you safety benefits with a decrease in noise.

How does it do that? What it allows you to do in a terminal area—New York/New Jersey is the best example—is it allows you to have aircraft fly during marginal weather the way aircraft fly during visual conditions today. When aircraft are flying under visual conditions in the terminal, they are flying what we call noise abatement approaches. They fly approaches that allow them to bypass, whenever possible, residential communities. When the weather goes down, they are on a very restrictive flight path, because of the limitations of today's landing guidance systems.

Microwave landing systems lets these airplanes fly in marginal weather the way they fly today. That is the noise reduction. In the New York area there are many times when the weather is down airports like, and I know this is your area, but I don't raise it for that, airports like Teterboro get shut down for hours so that we continue to move traffic in and out of La Guardia and Newark. The microwave landing system allows those airports to operate simultaneously with never an impact on one of them.

We ran into a contractor who had financial difficulties, not technical difficulties, in a production procurement for MLS. We are still trying to resolve those financial difficulties. We believe there is a possibility that we can still take delivery of some production systems from the existing contract. We are entering into a demonstration phase. We have brought several microwave landing systems off the shelf. One of those systems goes into Kennedy Airport, another goes into Midway airport in Chicago. Both will be in place and in operation before the end of this calender year.

Mr. **Torricelli.** Let us go over that again. The Chicago one will be operational by this coming year?

Mr. **Del Balzo.** Yes. And so will the one at Kennedy Airport.

Mr. **Torricelli.** At Kennedy?

And how about La Guardia and Newark?

Mr. **Del Balzo.** La Guardia will come when we take delivery either from the existing contract or from a second procurement that we are now negotiation for an additional 26 systems off the shelf. If we can take delivery from the existing contract, deliveries will start in nine to 12 months. If we have to buy 26 systems off the shelf, you are probably talking 12 to 18 months.

Mr. **Torricelli.** So somewhere inside of 18 months at La Guardia and Newark you will have a system installed?

Mr. **Del Balzo.** I think that is doable. Yes, sir.

That is a conditional yes. Conditioned on whether or not there is user to participate in the demonstration program. At Kennedy Airport there is user interest to participate. There are operational benefits to be demonstrated, and noise benefits to be demonstrated.

At Midway Airport there is user interest. At Philadelphia there is user interest, at La Guardia there is user interest.

Mr. **Torricelli.** By user interest do you mean the operation—

Mr. **Del Balzo.** Airlines willing to equip their airplanes to take advantage of the capability.

Mr. **Torricelli.** I wonder if there is an interest or an effort within the FAA to predict some of the difficulties of airplane noise when you make changes. This entire change in the East Coast plan, for example, where changes were made, for one reason or another, and then you faced an avalanche of criticism and comments—nothing compared to what we received, but never the less, you received some.

Mr. **Del Balzo.** We could match what you got.

Mr. **Torricelli.** Is there not an ability, by establishing computer models or other means, to predict what it is we are going to find when we make these changes?

Mr. **Del Balzo.** Mr. McDaniel will talk about the technical response to that.

Let me, if I might just talk a little bit philosophically first regarding the East Coast Plan.

Look, I was there. I was there when it happened. I was kind of the orchestrator for the East Coast Plan. We underestimated community reaction to the noise impact. We underestimated it because we didn't realize that communities and residents were now so sensitive to noise that they have never heard before, even though the noise levels they are now being exposed to were within the tolerable limits as defined by standards. We just missed that. If we had it to do over again, we would have clearly done it differently.

Mr. **Torricelli.** But if you had to do it again, would we now know enough to know the difference?

Mr. **Del Balzo.** Yes, sir.

Mr. **Torricelli.** Because of the sensitivity of the individuals, not because of establishing any kind of a model or scientific ability to predict.

Maybe that just doesn't exist, but that is what I would like to know.

Mr. **McDaniel**. Actually, because of both. The models which we were discussing earlier that allow you to measure noise around airports are really the same models that we would use to measure situations like the Expanded East Coast Plan, and we do have the capability to anticipate what community response would be.

The standards that we were talking about, the LDN measure, really allows you to estimate what it is that you could expect in terms of community response in various situations. I think we are better equipped to do that now than what we were, and I think the approach that we would take in such a situation is exemplified by what we did in Seattle as an alternative to what we did in the Expanded East Coast Plan. There we were able to work with the community, and a lot of noise response is psychological and social as well as technical.

If the community thinks that they have not been consulted, someone is working against them, does not understand their problem, and then sets up an opposition force, they are more likely to respond in an angry way, than if they think, well, someone does understand, they are working with me, they are trying to make it better for me, and that is really what we did in the Seattle situation, and I think the outcome has been much more successful. We are looking at those measures. We are looking at how to put them into place to better anticipate it. We are looking at what procedures can we use to make it better for the community, better for the airport, better for the user, to come to some understanding about that.

Mr. **Torricelli**. At this point, let me call upon Mr. Lewis to ask some questions, and I do have some other areas that I would like to explore, and I will return to them after my colleagues can have an opportunity to ask some questions.

Mr. Lewis?

Mr. **Lewis**. Thank you, Mr. Chairman.

Mr. Del Balzo, last year GAO testified that during the fiscal year 1988, reprogramming actions which changed funding in 70 of 99 subprograms that you had designated in your Congressional submission, 18 of these increased by about $500 thousand and there were several between $3 million and $9 million. Has the practice of reprogramming changed or is it still remaining the same?

Mr. **Del Balzo**. Congressman, I think the practice of reprogramming during the fiscal year will always be a way of doing business, since it allows us to react to changing conditions real time. What has happened in the past year, and I don't have specifics, I would be happy to furnish it for the record, but what has happened this past year is much, much less reprogramming. The need for reprogramming has been much less, because we went into the fiscal year with a much better thought out R&D programs. I do not have the exact numbers, but I assure you that it is much less.

Mr. **Lewis**. Well, we also have seen last year during the GAO testimony that FAA had not established a criteria for approving transfer funds among R&D programs, so you had no means to insure that it would spend funds in accordance with the priorities that you had submitted to Congress. Has this been changed?

Mr. **Del Balzo**. We are in the process now of changing that in a very detailed way with the establishment of the new systems engineering organization under Mr. Pozesky, where reprogramming actions get evaluated and get approved in a single point in our organization. A year ago we were not positioned to handle programming actions that way.

Reprogramming actions now take place in a much more analytical way based on our own priorities. Yes, sir.

Mr. LEWIS. Also, last year the question was raised by the Science and Technology Committee receiving the FAA budget testaments which included your R&D estimates for resource programs. In order to clear up this policy, Chairman Roe sent a letter in 1989 to the DOT Secretary Skinner asking for attention to this matter. To this point the committee has not received a reply. This problem apparently still exists, so despite these assurances we still do not have this information. Could you check into that for us?

Mr. DEL BALZO. Yes, I will.

Mr. LEWIS. Okay.

One other thing that is sort of a sticky thing with the science committee and our subcommittees, is on the cover of the FAA budget estimates for fiscal year 1991 is printed a statement "submitted for use of the committees on appropriations," and it appears that the science and tech committee is being short changed or ignored in the submission of budget information to Congress, and in as much that we are the authorizing agency, what do you think FAA can do to correct this problem?

Mr. DEL BALZO. Can I look into that one too and submit it for the record?

Mr. LEWIS. Yes, sir. You sure may.

Mr. DEL BALZO. Thank you.

Mr. LEWIS. I want to ask about some of the research programs for fiscal year 1991 which totaled $46 million which I think is very good, and unfortunately, the amount for long term fire safety is only $500 thousand, and the amount for long term human factors totals $1.3 million, and for long term aging aircraft is $570 thousand. Why are funding levels so low in these areas?

Mr. DEL BALZO. When you look at the aging aircraft program, we are in the process of establishing a long term research capability. I do not believe that today we are positioned to spend much more money in terms of long term research on aging aircraft until we get a program in place and a capability established.

Our intention is to establish that long term research capability through two universities, that we are not focusing on a consortium of universities and NASA. I would hope that by the end of this fiscal year that we would have an approach laid out to establishing a long term research capability.

Mr. LEWIS. I guess what my concern is particularity in the aging aircraft, we have had two aging aircraft conferences, we have a task force that has come back with recommendation for both the major manufacturers of aging aircraft. It would seem to me that we should have some short term R&D programs projected that would dove tail into the long term at this point.

Mr. DEL BALZO. Well, I agree with that. I agree on the short term. When one looks at what we have done since those accidents occurred, we have processed several ADS—several Aircraft Worthiness Directives that already have influenced how maintenance and inspections get done on aircraft. Those are the short term accomplishments that have taken place.

The truth is we do not yet have a long term approach to the aging aircraft problem. We are still sorting that through.

Mr. **Lewis**. I guess I also wonder why we only have $500 thousand committed to long term fire safety programs.

Mr. **Del Balzo**. That number doesn't sound right to me, sir. But if it is—

Mr. **Lewis**. Yes, 500 thousand dollars is committed for long term fire safety program for R&D.

Mr. **Del Balzo**. I would like to research that one with your permission, and verify the number and exactly what we are doing in long term cabin fire safety research.

Mr. **Lewis**. Okay, I guess staff has handed me the research projects, and it does show $500 thousand. That seems to be the highest mortality rate determined in any aircraft fire rather than human error, so—

Mr. **Del Balzo**. The most significant effort that we now have underway in cabin fire research is the water spray system that we are doing jointly with the United Kingdom—

Mr. **Lewis**. It is most impressive.

Mr. **Del Balzo**. And Canada. Yes. That is the most significant effort that is now underway.

Mr. **Lewis**. Well, are we going to continue to look at this for fireblocking material in aircraft? I know FAA has done an excellent job to date in all interiors, and I am very much impressed, personally, with what I see and the time requirements to make the change over by the airlines, but it would seem to me now that we do now have two, three, four minutes, sometimes even five in certain cases, but that is still—we don't stop there. I want to see if we can protect even more—go even beyond that period.

Mr. **Del Balzo**. The answer to what it is that we will be doing in the whole area of both aircraft safety research and security-terrorism research—I think that you will be impressed with the answer that we developed as it develops. That there is now new technological leadership at the technical center. With the new technical leadership we have transferred authority for the management and leadership of those two research programs directly to the technical center in New Jersey.

I think that you will see that the approach that we will take will be much more aggressive in both of those areas than it ever has in the past.

Mr. **Lewis**. I want to ask you several questions about something that bugs me a little bit. Under the Human Performance Research Program in aviation medicine has plans to report a study of effects of alcohol on pilot performance. This apparently is the only FAA related R&D in alcohol and drug abuse in aviation. Does the FAA have any plans to conduct research on the impact of alcohol and drug use on aviation performance?

Now I am familiar with the time spread and the alcohol levels and things like that, but just what in depth programs, and I don't care what the Airline Pilot's Association thinks about this. I don't mind going on record on that, but I want to know what FAA is doing, and what it is going to do as an in depth R&D on this.

Mr. Del Balzo. We are working now with CAMI. Between the Civil Aeronautical Medical Institute in Oklahoma City and our own technical center in New Jersey integrating the two capabilities to do two things.

One, to validate the .04 level, whether that is the right level for aviation. It may or may not be.

Secondly, to measure the human performance, the effects on human performance of different levels. I do not know exactly how we are going to do that, and what the techniques will be, but we are in the process of putting on a research plan between CAMI and the technical center.

Mr. Lewis. I would like, I believe and I think most of the members of this committee would agree, that we would like to see some type of priority put on the program and get the information as to what extent FAA is going to look into this. I discussed this with several experts in several areas on this. One in particular is Dr. Price of Virginia who I had a very interesting conversation with the other day, and not only was it interesting, it was frightening. I am very much concerned about what I consider—you have no control over this—the lack of policing by the FAA and the immediate blood sampling that should be necessary in the case of an accident and that sort of thing, and also by the inspecting, and I am referring to the Northwest problem where I think that that was absolutely abominable that we allowed that situation to happen. Just thankfully, nothing happened, but that doesn't necessarily mean that historically something couldn't have happen.

Mr. Torricelli. Would the gentleman yield?

Mr. Lewis. Yes, sir.

Mr. Torricelli. I wonder, when you feel confident that you have the appropriate standard. Is there a procedure at this point that is being envisioned for its enforcement or use?

Mr. Del Balzo. Work on that subject is just beginning, sir. No, there is not.

Mr. Pozesky. Mr. Chairman, let me add, you may be aware, that there are efforts being undertaking to correlate applications for pilot's licence to drivers registry to see if current applicants do have a history of alcoholism.

Mr. Torricelli. Is the worst of that now behind us that is taking place.

Mr. Pozesky. I think the precise answer is no. There is currently a proposed rule making. We have to go through the administrative process which lets us do that. Clearly the FAA is proposing to do that.

Mr. Torricelli. The questions that I think Mr. Lewis is suggesting about whether it is random sampling or otherwise instituting a procedure to insure that the appropriate alcohol levels are being complied with, there is not at this point envisioned how that would operate?

Mr. Del Balzo. I believe the answer to that is no, sir.

Mr. Torricelli. Thank you.

Mr. Lewis. Do you have any plans to expedite that particular program, or are you aware of any? I know this does not fall under you program.

Mr. Del Balzo. I am not—I can not give you a good answer.

Mr. LEWIS. I have another question here, Mr. Chairman.

The GAO testified last year, Mr. Del Balzo, that the FAA does not have readily available historical information on R&D subprograms such as a number of FAA staff on the projects or the projects milestones, and also the contractors who would be under a project manager and such things. Has that been corrected?

Mr. DEL BALZO. We are probably—

Mr. LEWIS. Or is that a correct statement?

Mr. DEL BALZO. It is a correct statement more true today than it was a year ago. More true today, because of the recent realignment and consolidation of the R&D program that we have just done. I assure you that it will not be true next year. Mr. Pozesky has that as one of his highest priorities. That will not be true next year.

Mr. LEWIS. Okay, so you do feel that the realignment will correct this big problem?

Mr. DEL BALZO. Yes, sir.

Mr. LEWIS. Mr. Chairman, I do not have any further questions at this point.

Mr. TORRICELLI. Thank you, Mr. Lewis.

I would like to recognize Mr. McMillen, and note that Mr. McMillen just scored 36 points for the Democratic team beating the Republicans, therefore, Mr. McMillen will have all the time he desires to question.

[Laughter.]

The witnesses are directed to provide him with exactly the answers he desires.

[Laughter.]

Mr. MCMILLEN. I have a better appreciation, Mr. Chairman, about what aging aircraft are all about.

[Laughter.]

Mr. MCMILLEN. It is great for me to be here today, because I have had an interest in this issue of airport noise, because of National Airport and BWI Airport.

The question that I would particularity like to ask is that on my March 8th note to the Administrator to ask what had become of the $2 million noise abatement study that was commissioned in 1987 as an amendment to the R&D budget at FAA. I have not received an answer from the Administrator yet, but maybe you may know what happened to that research program. Was this enough money? First of all I should ask you, are you aware of what happened with this?

Mr. MCDANIEL. Yes, I am familiar. The authorized amount was in the Aviation Safety and Noise Abatement Act which set aside, of the authorized amount, $2 million for research in particular areas. I apologize for the delay in the answer, which if it is not presently should be within a day on its way to you.

The amounts authorized for that research were not finally appropriated for that research, so all of the activities called for were not carried out. A number of them have been carried out. We worked with regard to sound proofing standards and the concentration of residences and schools and hospitals around airports which is one of the "foci" of the authorized legislation.

We worked with the Navy in defining standards, techniques, communicating ways in which this should be done and under what conditions, and have incorporated that into our standards for soundproofing. They are now using that as a guide.

Another feature of the legislation called for a study of better ways of dealing with developed areas around airports, particularity with regard with working with communities. We are very high ourselves in encouraging communities to use part 150 studies, which begin a dialogue between the airport, the community, the airlines and all those affected by noise.

We completed during this past year a part 150 survey working with the community at what changes we should make on part 150 studies, have completed the report which, I think, will make it easier for what I will call developed airports. Those are airports in which communities have already developed around the airport. They have found it historically difficult to use part 150 studies. I believe our recommendations will make it easier for them and encourage them to use the studies. So a number of the things called for in the legislation have, in fact, been done, but the total amounts called for were not appropriated to allow—

Mr. McMillen. How much was appropriated?

Mr. McDaniel. Of the total, I think there has been in a three year period about $5 million total in all of the noise related research, of which a considerable amount went to the activities described in the authorization.

Mr. McMillen. Our authorization was for only $2 million.

Mr. McDaniel. Yes.

Mr. McMillen. Somehow my basic math failed me right there. [Laughter.]

Mr. McMillen. Obviously what we were trying to do when we included the $2 million figure was to say to the FAA that this was a priority, and we hope that you do some specific research in this regard, and your response back to me was that not enough was appropriated, and you told me that $5 million was appropriated.

Mr. McDaniel. And I did not do the mathematics of how much of that $5 million was dedicated to the purchases. I know a considerable amount was dedicated to the purposes identified in the authorization.

Mr. McMillen. When will you be more specific in your—

Mr. McDaniel. I will be happy to provide that for the record.

[Material referred to follows:]

For projects involving noise-related research during the three years referred to, we have spent approximately $2.7 million.

Mr. McMillen. Now, is this a priority, Mr. Del Balzo? Is airport noise a priority of this administration?

Mr. Del Balzo. Airport noise is a priority. It is a priority for several separate reasons.

We talk about a capacity shortfall in the air traffic control system, and we talk about innovative ways to increase system capacity, we talk about the need for more airports. The need for more runways and runway extensions, doesn't mean anything; unless we solve the noise problem we will not have solved the capacity problem. We must address the noise problem. We must if not just in terms of just reducing levels of noise, we must address it from an educational standpoint. We must address it from a psychological standpoint. I do not believe that it is a problem that you can solve by just the numbers, but there is no question that the noise problem in the United States must be solved, or the transportation system in the United States someday comes to a halt.

Mr. McMILLEN. Well, I am hearing this time and time again. Dan Glickman and I sponsored an amendment a year ago on FAA research asking FAA consider aircraft noise abatement as one of its top priorities, and then I read through your testimony, Mr. Del Balzo, I look at page eight and members of the advisory committee were also instrumental in restructuring the contents of the annual RE&D plan into seven major research areas, and I don't see airport noise abatement in any of those categories. Then I see what Secretary Skinner has done with regards to dropping some of the momentum and impetus in this regard, and I am wondering if we are being slightly disingenuous here today about the intent to deal with this very serious problem.

Mr. DEL BALZO. Congressman, I hope not.

When one looks at the noise issue, you can attack it at the source and make engines as quiet as possible. Stage three, the introduction of stage three technology will help. We have a research program with NASA that is looking into the possibility of the development of even more quiet engines, stage four, stage five, but that does not solve the problem.

The problem continues to be one of perception and the reaction of people to noise, so there has to be a different way of addressing the problem other than just reducing it at the source. We look whenever we can to adjust air traffic control procedures in ways that have the minimum impact on the fewest number of people. Sometimes we do it successfully, sometimes we do not do it successfully.

The most successful way that we have achieved that is in what we would now call the Seattle Model where FAA is actively engaged in the community, with State and local governments and with the residents in the particular areas that are impacted—at the beginning in developing air traffic control techniques and noise restrictions, at the airports without restrictions, at the airports without compromising system capacity, I think we can do that.

Mr. McMILLEN. I applaud your efforts in this regard, but I think specifically, I want you to understand statutorily what Congress was telling the FAA. They said they wanted to formalize aircraft noise abatement as a research priority for the FAA, and although I am hearing what you are saying, I am also looking at seven subcommittees that were formed, and I am looking at Secretary Skinner, and I am not getting a sense that the FAA has responded to what Congress has wanted.

I know that the Chairman has worked on this issue, others have worked on it, is there a reason why the advisory committee did not form a subcommittee on airport noise abatement?

Mr. DEL BALZO. I think the simple reason is that we did not ask them to, so we may have been remiss. We will make a commitment that at our next advisory committee meeting we will, in fact, establish a formal subcommittee to address the issue.

Mr. McMILLEN. I don't want to continue every year to come up here to have a hearing and have to say, "Okay, we put more language in." We keeping building this legislative record that we consider this a priority. I have to go home and listen to this from my constituents, and they are very concerned. They are concerned at National. They are concerned at BWI. It has impact. It has impact on children going to school in the morning, and I just convey to you the sense that we feel that this is priority, and we hope that you will act accordingly.

Mr. TORRICELLI. Will the gentlemen yield?

Mr. MCMILLEN. Yes.

Mr. TORRICELLI. As you know I share your concerns on this. There is one solution to the aircraft noise problem that now I am listening to. So many people complain at home, it is drowning out the aircraft. I think what is important here is to recognize where there is some difference in philosophy. When I hear your descriptions of what can be done in approaches and in planning, it appears that the FAA thinks that that is the solution. To me that is only an interim in gaining time for the ultimate solution, and that the solution has to rest with technology. With a rapidity of growth in the near metropolitan area, for example, it will, in this generation, no longer be possible, with micro landing systems or other devices, to be able to bring aircraft in across rural, undeveloped areas, because there are going to be no rural or undeveloped areas. You cannot weave your way between schools and factories any longer. There is no place left to weave. The simple answer must rest in technology that reduces aircraft noise. I support your efforts to find better means to plan and direct aircraft in the near term, but eventually the answer has to be in a comprehensive program that forces the retirement of older aircraft, supports the funding for research on new engines or other technological means, and the time for that work to be done is clearly now, because the public is going to force those changes politically in the near term. I want to be certain that we understand each other philosophically and that you are not interpreting the fact that we appreciate the planning efforts that are being done as to be—I hold a similar belief that that is the eventual solution.

Mr. DEL BALZO. Yes, sir. A point well taken.

Mr. MCMILLEN. Can I just follow up with maybe one more question, Mr. Chairman?

The EPA looked at the environmental impact statement at the extension of the runway to BWI and said basically that they thought that the calibration was sufficient, because it was using an LDN based measurement as apposed to single event. There were a number of schools in the area that were being bombarded. Why are you so stuck on LDN? Why haven't you been willing to take another look at this, the whole LDN standard, given the fact that these standards have not really been readdressed since the sixties, and I am curious as to when the EPA which says, "We disagree to your approach to this airport," and you are relying on 20 to 25 year old standards when airports have changed, demographics have changed, people going to work have changed, the time they are going to work has changed, the time they are home—

Mr. MCDANIEL. We use the LDN standard, because we believe scientifically it is the best standard available. We are not unwilling to look at additional data which would substantiate, justify, a change in that standard. It was in response to the Aviation Safety and Noise Abatement Act of 1979 that the LDN standard was adopted. It was recommended by the EPA. We worked with the EPA, we worked with Housing and Urban Development with regard to construction standards, Department of Defense. The Council on Environmental Quality brought in the best experts that we had in terms of developing a measure which responds, we believe, to the direction we were given to establish a single measure.

We are continuing to look at LDN and additional information. The LDN measure has been updated somewhat to incorporate additional later social surveys, but it is still the best predictor. Now it needs to be supplemented in some cases by single event measures with respect to sound proofing and other things, and that is provided for in individual part 150 studies. If there is a justification for a supplement, that can be done.

Mr. McMillen. When you say you are taking a look at this, are you expending some dollars, are you formalizing a look at the LDN study?

Mr. McDaniel. There are two things immediately that are going on. One is that we are in cooperation with the EPA expending monies to look at noise levels, single event noise levels, in LDN contours with the expressed purpose of trying to identify whether or not the LDN contours miss something with regard to their application.

Secondly, we are working with the Air Force in defining a series of studies that they are doing out of Wright-Patterson to look at community response in situations defined LDN contours and other noise measures to see if their is additional information there.

We continue to look at all the social survey and annoyance response data in relationship to noise measures around airports to try to determine then, in fact, if we are using the best measures available. We want to use the best measures, and if LDN is not the best measure—I believe it is—but if it is not, we would like to find something new.

Mr. McMillen. Thank you, Mr. Chairman.

I just express my concerns given what Secretary Skinner has done and some of the slowness of foot, if you will, in terms of moving in the direction that I think Congress wants you to move. I just hope that we can focus on this, because, as our Chairman said, this problem is not going away. As you well know, it is going to be more on our minds, and hopefully your minds, in the years to come.

Mr. Torricelli. Thank you, Mr. McMillen.

In a peculiar way the Administration's actually provided a service. Deleting Secretary Skinner's recommendations on noise reduction in the National Transportation Plan, has highlighted the fact that there is indeed something disingenuous about the Administration's comments to date, about its concern with aircraft noise, by so brazenly, boldly eliminating any Federal emphasis, they have put us all on notice that if there is going to be a Federal commitment, it is going to have to come from the Congress, it is going to have to be watched, monitored closely, but the initiative is going to have to be ours.

Let me just raise just a couple of issues before the next panel. Would it make sense at this point in order to enhance the development and help the Nation understand the potential tiltrotor technology if the FAA were to provide a plan for how these aircraft might be located, the facilities that would be required, the potential in the national transportation system, the numbers of aircraft involved, the number of people that could be moved, and actually produced a conceptual model of the use of the technology in national transportation?

Mr. DEL BALZO. Mr. Chairman, I think the answer to that question is yes. What we have done up until now is just sight by sight, sight specific market analysis, so if you were to ask me the impact of tiltrotor technology in New York/New Jersey metropolitan area, I could answer that. If you were to ask me the impact in Miami, I could answer that. If you were to ask the national impact, with the introduction of swivel, tiltrotor technology would have both in terms of noise, capacity, and national benefits, I could not answer that.

Mr. TORRICELLI. My thinking, Mr. Del Balzo, is more that there is documentation that says to the stockholders and boards of directors of United Airlines, and the stock holders and board of directors of Texron or Boeing, that here is the scale of the market that the FAA envisions. Here is their thinking about how this would operate as an indicator of how eventually the FAA is going to rule on the regulation of the market, and how the aircraft is going to be treated, and how it will work in the transportation system. To them, while it provides no guarantees, it is a much better indicator of your thinking about the size of the market and how efficiently it will be able to operate. I think it will be a very useful tool to those who will consider making major investments.

Mr. DEL BALZO. We will consider an initiative regarding the tiltrotor system study. Thank you.

Mr. TORRICELLI. Finally, there has been a great deal of promise for a long time on this third phase of the automated en route ATC program, this concept of total automation, yet in the Administrator's vision paper it appears FAA is abandoning or having doubts about this third concept, and envisions much more at keeping a controller in the loop and not making this next transition. If indeed there is this conflict between the Administrator's current thinking and what is perceived to be the FAA's previous view, it doesn't appear to me to make a lot of sense to keep more than $8.5 million in authorizing transition to the next stage. Could you clarify this contradiction?

Mr. DEL BALZO. Yes, sir.

The role of a human in an automated system is not simple, it's full of traps, full of traps in the cockpit, full of traps in the air traffic control room as well. We have designed the evolution of an air traffic control system in the introduction of higher levels of automation. AERA-3 is the highest level of terminal automation. We have designed our implementation of automation in an evolutionary way, recognizing the need to always keep a controller in the loop, recognizing to always keep the pilot in the loop. We have not yet defined what keeping the controller in the loop actually means. It is not something we can do analytically; it is not something that we can do intuitively. The only way that you wind up defining the true role of a controller in an automated system is doing it by prototyping, doing by simulations, doing it by the gradual introduction of automation. The tools of automated aids that the controller can use, until you can reach a point where you can define a roll that—it could be a roll that says we can automate the air traffic controller out of the decision making process, but what I will tell you is that every research program that has started out that way has failed. Technology may make it possible to automate the controller out of the loop, that does not mean that it is the right thing to do in aviation.

We will not know that for several years, several years of intense testing.

Mr. POZESKY. Mr. Torricelli, let me add, if I might please, that we are very committed to doing the research associated with that project and that program. Mr. Del Balzo added some of the very considerations that we need to have in getting where that third phase of that capability which, I think, we call AERA-3, is understood. Without the research associated with that task we will never get there, so I would ask for your committee—

Mr. TORRICELLI. I guess the question is whether it makes sense to spend $8.5 million—

Mr. POZESKY. Absolutely.

Mr. TORRICELLI.—researching something that appears to me that you begin having enormous doubts about not withstanding the results of your research.

Mr. POZESKY. Let me try to answer that. My answer is yes. I don't think we have enormous doubts. I think that what we are trying to explain is that the balance of controller automation is an extremely critical balance. We have the question of how to get the controller involved without mesmerizing him if he is not an active part of the player.

That kind of research which Mr. Del Balzo is talking about is critical. That is being done as part of that project. Without the funds for that project, that research would never get done.

Mr. TORRICELLI. Yes, but my point seems to be that based on current experience with air traffic control, it appears to me that there are already some serious doubts about what you might prove to be possible technologically, that even if proven to operate, you already, based on you operation of experience, would not recommend going ahead. That raises doubts in my mind about the advisability of spending this amount of money.

Mr. DEL BALZO. I would say it a little bit differently than you just characterized. I am not sure that we have doubts about whether or not it is possible. The concern we have is about how we would introduce it in a way that is acceptable and practical.

The comment that I made that the research efforts that have failed have failed starting out with the premise that we will automate the human out of the system regardless, without doing the necessary research as to the how. When one thinks about the ultimate in automating the controller out of the system, one must also think then about the kind of redundancy that you would need, the fall back that you would need, and that doesn't necessarily have to be continued redundancy in the automation area. Redundancy could be an airborne collision avoidance device that will be in place. We just don't know enough about the how to decide whether or not it is practical.

Mr. TORRICELLI. Mr. Lewis, do you have any other questions?

Mr. LEWIS. Just one, Mr. Chairman, if I may.

I would just ask a question, Mr. Del Balzo. In 1987 several general aviation manufacturers provided FAA technical center with the fuselages of several commuter and business class aircraft, and the aircraft were provided to the FAA specifically to help define design criteria for seats and seat strength. The subcommittee has been advised that there has been very little work done in this area to date. Is the problem money or people or FAA interest.

Mr. DEL BALZO. I'm sorry, but I cannot answer that one intelligently.

Mr. LEWIS. Would you get back with an answer to that please.

Mr. DEL BALZO. Yes, sir. I will.

Mr. LEWIS. Thank you, Mr. Del Balzo.

Thank you, Mr. Chairman.

[Material referred to follows:]

In March 1988, the FAA Technical Center requested that the general aviation industry provide large general aviation and commuter airplanes to help define the crash impact characteristics of FAR Part 23 commuter category airplanes. Several commuter airplane manufacturers contributed fuselage specimens for the the test program. Additional specimens were provided through other Government agencies. In the summer of 1988, the FAA received the results of a research effort which compiled, from the National Transportation Safety Board, accident data on commuter airplane accident events for the years 1978 through 1986. The FAA analyzed the data and determined the appropriate test environment to evaluate the airplane specimens. A draft test plan was developed in late 1988.

At the same time, the FAA Technical Center's Drop Tower was refurbished. The Technical Center initiated its test program with the drop of a Aero Commander Model 680E airplane in May 1989. A second test was conducted in November 1989, employing a Piper PA-24, and a third test was performed in February 1990, utilizing a Cessna 421B. Subsequent tests are scheduled to be completed through FY 1992. In addition, the test schedule will be expanded based on the availability of test specimens built by foreign manufacturers.

The results of these commuter type airplane tests will be used to support the following activities:

o Using existing FAA-developed crash dynamics computer modeling techniques, define and validate a commuter catagory airplane model that could be used to evaluate the survivability aspects of a variety of crash impact conditions.

o Determine airframe strength capabilities under impact load conditions in the vertical axis of the airplane.

o Determine floor-to-seat interface leads and occupant injury potential under vertical and longitudinal impact conditions.

o Evaluate airframe ridigity and the effects of structural deformation on the airframe strength and occupant protection.

o Define design techniques that optimize occupant protection in conventional metallic airframes.

Mr. TORRICELLI. Before terminating this part of the hearing let me inquire about the level of interest in the transitioning to a satellite based or Earth based referenced navigation system. The level of interest, how vigorously it is pursued and the expected timing.

Mr. DEL BALZO. The level of interest is extremely high. In fact, I do not believe that there is any knowledgeable person or organization that would deny that the system of tomorrow will be space based. We believe it. We also believe that tomorrow the satellite technology is actually today. We believe that you can introduce satellite technology incrementally. The first application of satellite technology will occur in the oceanic environment where a satellite is a communications link to provide surveillance data that we do not have today.

The second application will be in the domestic environment. We will see the introduction of satellites as a navigation aid complemented by LORAN-C, and then finally the ultimate use of satellite technology will be in the surveillance area—space based radars to replace ground based radars. We see the evolutionary introduction of satellite technology services. I do not think anyone would disagree that this is where we will look tomorrow.

Mr. TORRICELLI. Over what period of years?

Mr. DEL BALZO. I believe that you see the introduction of satellite technology beginning this fiscal year, actually doing demonstration programs in an oceanic environment using satellite technology.

I do not think you see full implementation of satellite technology, in particularity, on a worldwide basis when we are talking about international standards until probably the year 2000 and beyond.

Mr. TORRICELLI. And the domestic routes?

Mr. DEL BALZO. And the domestic routes as well.

Mr. TORRICELLI. Under what—

Mr. DEL BALZO. Well, I think you see the introduction of satellite technology our domestic incrementally when the DOD satellite configuration is in place, GPS, taking advantage of the results of the research programs under Mr. Pozesky's leadership to insure monitoring and system integrity. You will see GPS used the same way that LORAN-C is being used today. You will see it as a non-precision landing aid, and you will see it as an en route navigation device as will.

Mr. TORRICELLI. I'm looking for you to sight a year when you feel that this will be operational.

Mr. POZESKY. Let me try to finish, Mr. Torricelli. There is a whole range of capabilities. There is money in this years implementation request before the Congress to begin satellite implementation in about five different locations in the United States programmed primarily for telecommunications over Alaska and in backing up current circuits in the United States and then actually providing a substitute for ALASCOM communication, so we have actually started and are requesting funds this year with the Congress to implement this capability.

We are requesting money in this year to begin the design of a ground integrity system that will supplement GPS for non- precision navigation. We are debating internally on how that system—

what the technical design of that ground monitor system is, but the funds to begin the implementation are requested this year.

I could sight any date, frankly, from 1991 when we are requesting the funds. We will get the first kind of capability probably around 1993, 1994 in the telecommunications area, 1995 for the ground monitor for GPS, and I will think you will see satellites playing a role every year for the next 10, 15 years in our budget and in our planning.

Mr. TORRICELLI. So would you envision in ten years there has been a complete transition?

Mr. POZESKY. Oh no sir. Not a complete transition. Our intent is that in 10 years we will have the capability for satellite navigation.

I want to make a distinction between that and a transition, because a transition requires 230 thousand users buy airborne equipment. That is going to take a longer time, but the basic capability for navigation, I certainly would like to have in place within 10 years or less.

Mr. TORRICELLI. And to what extent are additions in the satellite network required to meet this capability?

Mr. POZESKY. Excellent question. I do not have a crisp answer for you, because when some people talk GPS they mean what I call capital G, capital P, capital S, that is what DOD is proposing right now. Others are talking about a generic approach to satellite navigation.

The DOD is currently proposing a 24 satellite system. At that level we have doubts that we can do a complete job because of failure modes. If one of those satellites fail, or if two of those satellites fail, we may not have full capability.

The question we have before us, both as an agency and as a country, is whether the civil community wants to supplement that with additional satellites. Whether we want to do the integrity monitor capability with satellites or on the ground — that is something that I can tell you we are not hesitant to propose if could prove that.

Mr. TORRICELLI. That is the question I really asked— whether internally anyone was now coming up with a definitive answer of whether the military system was adequate, what additions would be required, what that would cost—

Mr. POZESKY. Absolutely, and I can tell you that that is one of my personal priorities. I could talk about it for 20 minutes. I would like to give you a crisp answer next year in terms of what we see absolutely required, but 24 satellites is probably not enough. It is probably going to take 30 if you want to have assurance of redundancy. There is a national policy question associated with who pays for it. There is a national policy associated with what happens if the DOD decides that they no longer need that capability in their long term planning. It is a big question, and we are looking at it, and we hope to have a system architecture from such a system.

Mr. TORRICELLI. Thank you, sir.

Mr. Lewis?

Mr. LEWIS. Thank you, Mr. Chairman.

On page 13 of your testimony we talk about the two new prototype high update radar systems at Memphis and Raleigh- Durham, and as one who probably moves through Raleigh-Durham 30 to 40 times a year, both the C-Scan radar and the Mode-S at Memphis, I have heard some concerns about this. I do not know if you are telling all of the story here where they will be able to give the controllers more frequent position updates than the conventional radar when you have also reduced the spacing considerably in those areas from three miles down to sometimes to 500 feet. I guess I am concerned about what type — are we using these in instrument weather as well as VFR, or are we using specialized controllers to work with these? How are we doing that?

Mr. DEL BALZO. The technology at Raleigh-Durham will allow us to reduce the spacing between parallel runways from 4,300 feet—that is the current standard—to 3,500 feet or less. We have done the calculations. We believe it is doable.

Mr. LEWIS. You are speaking of moving the runways closer together to 3,500 feet apart.

Mr. DEL BALZO. To 3,500 feet. It does not affect the separation standards between airplanes on final approach. What it does is it allows us to treat two runways that are 3,500 feet apart as independent runways only being concerned about the longitudinal spacing between airplanes on a single runway and not having to worry about horizontal separation as well.

It will take specially trained controllers, and when we implement the technique at Raleigh-Durham the technique will be implemented with controllers that are specially qualified to operate in that environment.

We have done a tremendous amount of, not just technical testing, but operational testing as well with real pilots on real airplanes, and real controllers monitoring the traffic. We are satisfied that it is doable.

Mr. LEWIS. And you will be using this through both phases and all weather operations?

Mr. DEL BALZO. Yes, sir.

Mr. LEWIS. Okay.

Thank you, Mr. Chairman.

Mr. TORRICELLI. Thank you, Mr. Lewis.

Thank you, gentlemen, for your cooperation and your testimony this morning.

Mr. TORRICELLI. For our next panel we receive testimony Robert Everett, Chairman, FAA R&D Advisory Committee, and Frank Frisbie, Director, Area 1, Air Traffic Control Association. He will be accompanied by Suzette Matthews, General Counsel, Air Traffic Control Association.

Mr. Everett, Mr. Frisbie, Ms. Matthews welcome. Thank you for your testimony this morning. We will, of course, submit all of your testimony for the record, but I would welcome, at this point, any summary that you would like to give. I would, of course, you would keep it as brief as possible, so we have some time to engage in some questions, and give us a chance to explore a variety of other areas.

Mr. Frisbie?

STATEMENT OF FRANK FRISBIE, DIRECTOR, AREA #1, AIR TRAFFIC CONTROL ASSOCIATION; ACCOMPANIED BY: SUZETTE MATTHEWS, GENERAL COUNSEL

Mr. **Frisbie.** I am Frank Frisbie, before you today as Director of the Air Traffic Control Association. ATCA is a professional association of thirty-five years standing which has as its goal advancement in the science and profession of air traffic control and aviation safety. Its membership represents all facets of the ATC discipline, from civilian and military air traffic controllers, flight service station specialists, and the airways facilities technicians who operate today's systems, to those people who develop and produce the technology which on which the system depends, and its citizens, government agencies, and the airlines who use the system.

ATCA endorses and subscribes to the joint testimony of the National Aviation Associations Coalition, being presented to the subcommittee earlier.

ATCA appears individually before you to provide its views on reauthorization of the FAA research and development programs, and to urge you to ensure that the FAA has adequate resources in order to meet tomorrow's air traffic control challenges, as well as today's pressing needs.

As a preliminary matter, ATCA recommends that the legislation reauthorizing FAA R&D programs be of five years duration.

We believe the benefits of R&D do not accrue until the new concept or technology is matured and proceeds on to application/implementation, but that a consistent and adequate funding stream is needed in the developmental aspects so that we do get the payoffs of R&D. Moreover, the availability of adequate R&D funding, of an adequate R&D funding base over an extended period of time will permit FAA to take an extended view of future NAS requirements, to engage in long range planning and execution of R&D programs and projects, and get ahead of the power curve in developing and fielding new advanced systems as they are needed.

With regard to funding levels, ATCA recommends that Congress authorize and appropriate at least $260 million per year in fiscal year 1991 through 1995 for the FAA RE&D program. Although the amount recommended is one fourth greater that the Administration's $190 to $195 million proposal, both the need and the opportunity are very great.

Although during the recent past, many of FAA's RE&D resources were diverted to pressing NAS Plan needs, that is to say the F&E program, FAA is poised to embark upon a new and revitalized R&D effort which will prepare the Nation's air transportation system for the next century. In today's environment of exponentially increasing demand and rapidly advancing technology, FAA's program of RE&D is the key to meeting expanding public need for safe and efficient air traffic services. Just as investments made in aviation research and development in the 1960s yielded the NAS Plan technologies which are now coming into the field, so we must, as a Nation, invest today in a renewed and revitalized program of aviation research, which will prepare our aviation system to meet the demands of the 21st century.

The need for new and improved aviation technologies and products has never been greater. With air traffic rapidly outstripping the capabilities of today's air transportation system, we must continually develop and exploit innovative concepts and advanced technologies in order to meet tomorrow's aviation challenges.

Moreover, with the need to develop and field improved security products and mechanisms to combat international terrorism, FAA' existing RE&D funds are being stretched to the absolute limit.

As Mr. Del Balzo testified, FAA must accelerate the development of RE&D products and establish a fast-track mechanism to implement them on a priority basis, so that the agency will be in a position to meet near term NAS demands for improvements in safety, airport capacity, management of airport and human resources, airport security, and aircraft efficiency.

In addition to near term projects, FAA must develop a long range view of the intended evolution of the NAS as a basis for RE&D and R&E planning. FAA should be able to demonstrate this view in a national simulation laboratory, as mandated in the Aviation Safety Research Act of 1989, which is now their plan as they have testified earlier today, in order to obtain agreement from NAS operators and users, and to encourage compatible development in aircraft, aircraft systems, and where appropriate, airports where that simulation capability is required.

Near term research projects should emphasize the development of procedures, technology, and automation such as aging aircraft which we have talked about today, airworthiness technology, emphasized detection and other security technologies, cabin safety research, and radar and automation technologies to reduce runway incursions and extend the use of multiple approach streams in instrument conditions, thereby enhancing airport capacity and reducing delays.

FAA also must be encouraged to provide the necessary procedures and resources to expedite the transition from RE&D to implementation. Current FAA Technical Center resources are consumed by implementation of the NAS Plan, and research activities are receiving lower priority. An appropriate mechanism needs to be developed and funded to provide a fast track to field testing and implementation of successful prototype developmental products.

FAA must continue apace with ongoing engineering and development of advanced technologies such as data link, advanced traffic management, Automated En Route Air Traffic Control Phase 3—AREA 3—automatic dependent surveillance, terminal automation, and surface automation.

Greater research emphasis must also be placed on human resource issues. While most of these research ideas will be integrated into or complement the Advanced Automated System, some can provide near term system improvements before full implementation of the AAS.

For example, early implementation of data link operating with the en route host computer, and in the terminal environment to provided automatic general message communication in ATIS language, and the development and implementation of automatic dependent surveillance which has safety applications worldwide, must be pursued aggressively in our view.

All of these ongoing R&D programs, many of which were mandated by the Aviation Safety Research Act of 1988 are necessary and worthy of our dollars as well as our approval. However, judging by past problems in bringing research to fruition, FAA must be empowered with adequate and appropriate resources, human and financial, to meet the challenges facing aviation.

As a fundamental principle, FAA should be provided whatever resources are necessary in order to explore freely those concepts and technologies which will bring added safety and efficiency to air transportation. In the context of limited Federal dollars, however, ATCA urges Congress to authorize and appropriate a minimum of $260 million per year over the next five years. With this baseline in mind, FAA can return to this subcommittee for additional support should its research efforts yield new, promising products which require additional funding in order to reach their full potential.

In addition to adequate funding, FAA also must have access to the best and brightest of scientists, engineers, and managers in order to meet the formidable RE&D challenges that they face. FAA must be encouraged to proceed with, and expand internal initiatives underway to increase the number of scientific/technical and SES positions at the agency over and above personnel already on board or authorized. Moreover, a mechanism needs to be created which assures that those individuals who are added to the RE&D workforce will remain dedicated to those tasks, and not subject to diversion to other agency needs. ATCA believes, however, that pay and other incentives should be part of a comprehensive reform of FAA's personnel structure which would give the agency flexibility to set wages and salaries for positions at various facilities with regard to local cost of living and other factors which affect recruitment.

ATCA is especially concerned that inflexibilities inherent in the existing federal compensation structure make it impossible for FAA to attract qualified scientists and engineers who are more highly paid in the private sector. ATCA endorses draft legislation which would increase FAA's flexibility in this area, prepared by the Coalition and presented to the Aviation Subcommittees of both Houses of Congress, in conjunction with the hearings on an independent FAA. ATCA also eagerly awaits the Administration's comprehensive legislative plan for modernizing and improving the entire Federal personnel structure.

In conclusion, if the Nation's air transportation system is to keep pace with the demands of tomorrow's economy, FAA must have the funding, personnel and management tools necessary to develop and field the ATC and other aviation technologies, products and services required by an expanding aviation marketplace.

It is time to abandon the misguided notion that FAA can do more with less, and to recognize that FAA cannot engage in the highest quality research and development for an expanding market with diminished resources.

ATCA urges Congress to join with the Administration in making aggressive funding support for FAA research, engineering, and development a special national priority.

Thank you, Mr. Chairman.

[The prepared statement of Mr. Frisbie follows:]

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STATEMENT OF

THE AIR TRAFFIC CONTROL ASSOCIATION, INC.

BEFORE THE

SUBCOMMITTEE ON TRANSPORTATION, AVIATION, AND MATERIALS

COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY

UNITED STATES HOUSE OF REPRESENTATIVES

April 26, 1990

Mr. Chairman and Members of the Subcommittee, I am Frank L. Frisbie, a Director of the Air Traffic Control Association, Inc. ATCA is a professional association of thirty-five years standing which has as its goal "advancement in the science and profession of air traffic control and aviation safety". Its membership represents all facets of the air traffic control discipline, from civilian and military air traffic controllers, flight service specialists, and airways facilities maintenance technicians who operate the Nation's air traffic control system, to those who develop and produce the technology which operates the system, to the citizens, government agencies, and airlines who use the system.

ATCA endorses and subscribes to the joint testimony of the National Aviation Associations Coalition, being presented to the Subcommittee by James Gormley of the General Aviation Manufacturers Association.

ATCA appears individually before you to provide its views on reauthorization of the Federal Aviation Administration's research, engineering and development programs, and to urge you to ensure that FAA has adequate resources in order to meet tomorrow's air traffic control challenges, as well as today's pressing needs.

As a preliminary matter, ATCA recommends that legislation reauthorizing FAA's research, engineering, and development programs be of five years duration. Whereas the benefits of RE&D

do not accrue until the new concept or technology is matured and proceeds on to application/implementation, a consistent and adequate funding stream in the developmental stages is absolutely critical if the payoffs of RE&D are to be realized. Moreover, the availability of adequate RE&D funding base over an extended period of time will permit FAA to take an extended view of future NAS requirements, engage in long range planning and execution of RE&D programs and projects, and "get ahead of the power curve" in developing and fielding new advanced systems as they are needed.

With regard to funding levels, the Air Traffic Control Association recommends that Congress authorize and appropriate at least $260 million per year in Fiscal years 1991-1995 for FAA Research, Engineering and Development. Although the amount recommended is one fourth greater than the Administration's $190 to $195 million proposal, both the need and the opportunity are very great. Although during the recent past many of FAA's RE&D resources were diverted to pressing NAS Plan needs, FAA is poised to embark upon a new and revitalized RE&D effort which will prepare the Nation's air transportation system for the next century. In today's environment of exponentially increasing demand and radidly advancing technology, FAA's program of research, engineering and development is the key to meeting expanding public need for safe and efficient air traffic services. Just as investments made in aviation research and development in the 1960's yielded the NAS Plan technologies now being realized, so must we as a Nation invest today in a renewed and revitalized program of aviation research, which will prepare our aviation system to meet the demands of the twenty-first century.

The need for new and improved aviation technologies and products has never been greater. With air traffic rapidly outstripping the capabilities of today's air transportation system, we must continually develop and exploit innovative concepts and advanced technologies in order to meet tomorrow's aviation challenges. Moreover, with the need to develop and field improved security products and mechanisms to combat international terrorism, FAA's existing RE&D funds are being stretched to the absolute limit.

FAA must accelerate the development of RE&D products and establish a fast-track mechanism to implement them, on a priority basis, so that the agency will be in a position to meet near term NAS demands for improvements in safety, airport capacity, management of airport and human resources, airport security, and aircraft efficiency. In addition to near term projects, FAA must develop a long range view of the intended evolution of the NAS as a basis for RE&D and F&E planning. FAA should be able to demonstrate this view in a national simulation laboratory, as mandated in the Aviation Safety Research Act of 1989, Pub. L. 100-591, and now planned, in order to obtain agreement from NAS operators and users, and to encourage compatible development in aircraft, aircraft systems, and, where appropriate airports

Near term research projects should emphasize the development of procedures, technology, and automation such as: Aging aircraft inspection/airworthiness technology, emphasized detection and other security technologies, cabin safety research, and radar and automation technologies to reduce runway incursions and extend the use of multiple approach streams in instrument conditions, thereby enhancing airport capacity and reducing delays.

FAA also must be encouraged to provide the necessary procedures and resources to expedite the transition from RE&D to implementation. Current FAA Technical Center resources are consumed by implementation of the NAS Plan, and research activities are receiving lower priority. An apropriate mechanism needs to be developed and funded to provide a fast track to field testing and implementation of successful prototyped development products. FAA must continue apace with ongoing engineering and development of advanced technologies such as data link, advanced traffic management, Automated En Route Air Traffic Control Phase 3 ("AERA 3"), automatic dependent surveillance, terminal automation, and surface automation. Greater research emphasis also must be placed on human resource issues. While most of these research ideas will be integrated into or compliment the Advanced Automation System, some can provide near term system improvements before full implementation of the AAS. For example, early implementation of data link operating with the en route

Host Computer, and in the terminal environment to provide automatic general message communication in ATIS language, and the development and implementation of automatic dependent surveillance (ADS), which has safety application to the oceanic ATC environment, with extensions worldwide, must be pursued agressively.

All of these ongoing R&D programs, many of which are mandated by the Aviation Safety Research Act of 1988 are necessary, and worthy of our dollars as well as our approval. However, judging by past problems in bringing research to fruition, FAA must be empowered with adequate and appropriate resources, human and financial, to meet the challenges facing aviation. As a fundamental principal, FAA should be provided whatever resources are necessary in order to explore freely those concepts and technologies which will bring added safety and efficiency to air transportation. In the context of limited federal dollars, however, ATCA urges Congress to authorize and appropriate a minimum of $260 million per year over the next five years for FAA Research, Engineering and Development. With this baseline in mind, FAA can return to this Subcommittee for additional support should its research efforts yield new, promising products which require additional funding in order to reach full potential.

In addition to adequate funding, FAA also must have access to the "best and brightest" of scientists, engineers, and managers in order to meet the formidable RE&D challenges ahead. FAA must be encouraged to proceed with, and expand internal initiatives underway to increase the number of scientific/technical and SES positions at the agency over and above personnel already on board or authorized. Moreover, a mechanism needs to be created which assures that those individuals who are added to the RE&D workforce will remain dedicated to those tasks, and not subject to diversion to other agency needs. ATCA believes however, that pay and other incentives should be part of a comprehensive reform of FAA's personnel structure which would give the agency flexibility to set wages and salaries for positions at various facilities with regard to local cost-of-living and other factors which affect recruitment. ATCA is especially concerned that inflexibilities inherent in the existing federal compensation structure make it impossible for FAA to attract qualified scientists and engineers who are more highly paid in the private sector. ATCA endorses draft legislation which would increase FAA's flexibility in this area, prepared by the Coalition of National Aviation Associations and presented to the aviation subcommitties of both Houses of Congress, in connection with hearings on "Independent FAA." ATCA also eagerly awaits the Administration's comprehensive legislative plan for modernizing and improving the entire federal personnel structure.

In conclusion, if the Nation's air transportation system is to keep pace with the demands of tomorrow's economy, FAA must have the funding, personnel and management tools necessary to develop and field the ATC and other aviation technologies, products and services required by an expanding aviation marketplace. It is time to abandon the misguided notion that FAA "can do more with less," and to recognize that FAA cannot engage in the highest quality research and development for an expanding market with diminished resources. ATCA urges Congress to join with the Administration in making agressive funding support for FAA research, engineering, and development a special National Priority.

Thank you for the opportunity to present these views.

Mr. TORRICELLI. Thank you.

Mr. Everett?

STATEMENT OF ROBERT EVERETT, CHAIRMAN, FAA R&D ADVISORY COMMITTEE

Mr. EVERETT. Thank you, Mr. Chairman.

As you know, our committee was created as part of the FAA's resonance to the 1988 Aviation Safety Research Act. We have been in business for slightly less than a year now, and we have had four meetings of the full committee. It seemed that almost immediately that we needed to look at the process and organization priority as well as make an initial technical R&D program. We set up two subcommittees, one under Lynn Helms, former FAA Administrator to look at organization and, one under John McCarthy who was Research Manager at the National Center for Atmospheric Research to look at the research.

Since then, we have set up five other subcommittees, Airport and Airspace Capacity chaired by Mr. Don Reilly; Tiltrotor Aircraft Technology, chaired by Norm Augustine; Air Transport Aircraft Safety chaired by Mr. Robert Aaronson; Human Factors and Aviation Medicine chaired by Dr. Rapmond, and the National Simulation Laboratory, chaired also by Lynn Helms.

The first two have completed their work and have reported to the committee. The other five are still in process. All of these subcommittees contain members from the full committee, but are augmented by other people to fit the particular needs, so that we have access to large numbers of specialists as needed.

The RE&D Process and Organization Subcommittee reported that it was not clear R&D gets done in the FAA, or how and where ideas and projects get originated. It was not clear what the organization was to do the R&D, there is no single point for R&D decision or control. The FAA is lacking in in- house technical expertise. It wasn't that there were no people, it was just not enough to handle all these problems, and even when the FAA does come up with something that is very good, and this happens quite often, it takes too long to get anything in the field.

Part of this is because most of the RE&D funds of recent years have been spent on the NAS Plan. They also felt that the operational organizations were not full participants in the FAA's R&D program. Now these conclusions are not surprising. Establishing a good R,D&D program is a difficult task, and getting the results of that program is even a more difficult task. The Department of Defense has a lot of trouble with this, as I am sure you are aware, despite their much greater resources and elaborate procedures.

Everybody I know of in Government and industry is concerned about time to market, and a lot of thought and effort is required. This is true in the FAA as well.

Partly as a result of this subcommittee's report, and of course of the new Administrator's philosophy, the FAA, as Joe Del Balzo says, has completed a restructuring of the office of the Executive Director for Systems Development. We were concerned at first blush that the R&D function was being deemphasized, when it seemed like it was being embedded in the newly formed Office of the Administrator for Systems Engineering and Program Development, but as we heard in our last meeting, however, that this is done to view the problem of implementing R&D, to make sure that the things are done actually are going to bear fruit in the field.

The Systems Engineering Organization's charter is to oversee the conduct of all system development programs whether they are R&D or NAS Plan programs from concept to completion, and to be the advocate for expediting those programs. This seems to be an appropriate step forward.

The FAA is also responding to the second major criticism, the lack of in-house technical expertise. The FAA is using outside organizations like Lincoln Labs and NCAR. They have announced their intention to create a Federally funded research and development center, and they are exploring various devices such as intergovernmental personnel assignments to bring in talent where they can.

I certainly support what Frank said about the need to get more people to improve the attractiveness of Government activities and so on to skilled people. I think the FAA has to do everything it can within its present limitations to get some people aboard.

Also the RE&D Technical Review Subcommittee reported they concurred with the process of the Organizational Subcommittee. They were concerned with the RE&D plan was uninformative, and it was really lacking in technical content in failing to establish priorities. They were concerned that the four mission areas which were organized at that time— safety, security, capacity and efficiency—were confusing and mixed too many topics together to be clearly understood, and they were recommending eight technical areas which were the ones that Joe Del Balzo mentioned.

They also recommended the creation, where they didn't already exist, of technical peer review groups for each area under the auspices of the Advisory's Committee Technical Review Subcommittee, and we are in the process of setting that up. I am going to chair that subcommittee temporarily using John McCarthy and others, and we will set up those peer groups.

Joe responded to the Technical Review Subcommittee's recommendations. He happened to have the staff reorganize and the RE&D Plan—I think to its benefit.

Human factors is an important area, and Dr. Rapmond's committee has been reviewing this, visiting the laboratories and so on.

The 1988 Aviation Act also identified the need for the FAA to have the National Simulation Laboratory to do systems rather than component research to help the FAA understand how the new technologies, automation, or procedures will impact with the capacity and safety of the NAS.

We certainly support that idea, and as I said, Lynn Helms is looking into it, and we expect him to report to that at our next meeting. Our next meeting is scheduled for June. Committee meetings are open to the public. They include discussions with the Administrator and his staff, reports by subcommittees, and discussions of new activities. They also include visits to various RE&D facilities to give the group an opportunity to see work on the way and to talk to the people who are actually carrying out the research.

We expect to meet at least this frequently, at least until we have an opportunity to review the entire program and to make some constructive overall recommendations.

The committee has not yet had a chance to pull this all together and to make some overall recommendations, but I would like to present you with some personal views.

First, it is apparent there is not any consistent definition of R&D, either within the advisory committee or the air traffic control community in which the advisory committee is quite representative. We are a mixture of research, managers, and ATC system users. The committee, of course, was set up in that way, because it is to make sure not only that good research gets done, but that that good research turns into capabilities, and to do that, one has to have a mixture of users as well as researchers.

Researchers are advocates for increased long term research while the main focus of system users is in expedition and new capabilities into operation. The focus on implementation of research results is obviously important for both long term and near term R&D, and it is important to strike a proper balance.

Secondly, you are, I am sure, interested to what the advisory committee's recommendations are as to the appropriate size of the budget. The short answer is that we are not ready to answer that question. To do it properly, we must assess the requirements associated with alternative possible system features, and develop an R&D program that provides an appropriate set of contingent technologies to meet these features.

One has only to think of the possibilities of satellite based ATC, which we were all talking about earlier. To imagine how different the future system might be, in this regard, the FAA has two important activities under way.

One of these is a high level futures system definition activity, and the other is Administrator Busey's initiative with the Deputy Administrator and the Executive Directors to develop an agency wide strategic plan. It is in the context of this work that an RE&D plan has real validity.

We are monitoring these activities and expect to develop an independent assessment of the scope and size of the FAA RE&D budget.

Meanwhile, we will continue to pursue our subcommittees and to look at those particular aspects of program management that are of special importance to the Administrator.

Thank you.

[The prepared statement of Mr. Everett follows:]

Testimony of Mr. Robert Everett, Chairman,
FAA's RE&D Advisory Committee
26 April 1990

Mr. Chairman, I am pleased to have this opportunity to discuss the work of the FAA's RE&D Advisory Committee during its first full year, the impact of that work on the FAA, and my views on the FAA's RE&D needs.

As you know the RE&D Advisory Committee was created as part of the FAA's response to the 1988 "Aviation Safety Research Act" (PL100-591). The Advisory Committee was chartered to provide the Administrator with "advice and recommendations . . .regarding needs, objectives, plans, approaches, content, and accomplishments with respect to the Aviation research program", and "assure such research is coordinated with similar research conducted outside of the FAA". This committee has been in operation less than a year, and has had four full committee meetings since its creation.

The committee members are well-chosen, knowledgeable, concerned, and hard working. It was apparent from the first meeting that this committee needed to understand the FAA's RE&D process and organization and to provide an initial technical review of the FAA's RE&D programs as described in the FAA's FY91 RE&D Plan. The committee's first two subcommittees: 1)FAA RE&D Process and Organization Review chaired by the Honorable J. Lynn Helms, former FAA Administrator and 2) FAA RE&D Technical Review chaired by Dr. John McCarthy, Research Manager at the National Center for Atmospheric Research (NCAR) were commissioned and have reported their results to the full committee. I'll discuss these results in a few minutes.

Five other subcommittees have been formed to examine areas identified either in the 1988 Aviation Safety Research Act or by Administrator Busey:

- Airport and Airspace Capacity, chaired by Mr. J. Don Reilly (formerly AOCI),
- Tiltrotor Aircraft Technology, chaired by Mr. Norman R. Augustine, CEO Martin Marietta,
- Air Transport Aircraft Safety, chaired by Mr. Robert J. Aaronson, President of ATA,
- Human Factors and Aviation Medicine, chaired by Dr. Garrison Rapmond, Aviation Medical consultant, and,
- Dynamic Simulation Model (now being called the National Simulation Laboratory), chaired by Honorable J. Lynn Helms.

The work of these subcommittees is still in progress.

All of the identified subcommittees include full committee members and other support personnel. The subcommittees meet as often as needed separate from the full committee, and provide reports at the full committee meetings.

As promised I'll briefly summarize the results of our first two subcommittees, and indicate what impact they have had on the FAA.

In August 1989 the RE&D Process and Organization Subcommittee reported:

- It is not clear where R&D gets done in the FAA, or where or how ideas/projects get originated.
- There is no clear cut organization to do the FAA's R&D; there is no single point for R&D decision or control.
- The FAA lacked the in-house technical expertise (talent) to do R&D effectively.
- No "One" is in charge of making sure something "worthwhile" gets implemented.
- Even when the FAA tries to expedite the development and implementation of a potentially valuable product (Precision Runway Monitor is an example), it takes too long to get anything to the field.
- Up until recently most R&D funds have supported the NAS Plan's infrastructure rejuvenation (i.e., AAS, VSCS, RCL, ASR-9/Mode S Sensor, etc.)
- Up until recently, the operational organizations were not full participants in the FAA's R&D program.

These conclusions are not surprising. Establishing a good R&D program is a difficult task and transitioning the results of R&D into operational capability is even more difficult. The Department of Defense has a lot of trouble with this process despite its much greater resources and more elaborate procedures. There is much concern everywhere in government and industry, about "time to market". Much thought and effort is required.

Partly in response to this subcommittee's report and, of course, the new Administrator's philosophy, the FAA has recently completed a restructuring of the Office of the Executive Director for Systems Development.

We were concerned at first blush that the R&D function was being deemphasized when we noted that, it had been embedded within the newly formed Office of the Associate Administrator for System Engineering and Program Development. As we heard in our last meeting, however, the FAA has taken the step to deal with the problem of implementing R&D, one of the criticisms leveled by Lynn Helm's subcommittee. The System Engineering organization's charter is to oversee the conduct of all system development programs (whether they be R&D or NAS Plan programs) from concept to completion, and to be the advocate for expediting those programs. This intent is certainly correct and the RE&D Committee will be watching the results closely.

The FAA is also responding to the second major criticism offered by the Helm's subcommittee, i.e., the lack of in-house technical expertise to do the RE&D function. In this regard the FAA plans more extensive use of quality R&D organizations such as Lincoln Labs and NCAR. Next, they have announced their intention to create a Federally Funded R&D Center at the MITRE Corporation to provide a more highly leveraged use of that experienced capability. Further, they are exploring greater use of such devices as Intergovernmental Personnel Assignments to bring talent from the aforementioned organizations and universities for in-house service. Finally, they plan a more innovative strategy for bringing University talent to bear on the pressing research needs of the agency.

Also, last August, the RE&D Technical Review Subcommittee reported;

- They concurred with the RE&D Process and Organization Subcommittee
- The Draft FY91 RE&D Plan was "quite uninformative, lacking in technical content (as if written by a third party not familiar with the actual work), and failing to establish priorities in a coherent manner".
- The plan's 4 major mission area focus: safety, security, capacity, and efficiency was confusing and mixed too many RE&D topics together to be clearly understood.
- They recommended 8 technical areas:
    - ATC Safety Technology (includes aging aircraft, fire protection)
    - Capacity and ATC Technology (includes ATC automation on the ground and in the air to maximize utilization of all ATC resources)
    - System Security Technology (includes screening systems for passengers, baggage, and cargo)

  - Human Factors (includes improving human performance and preventing human errors)
  - Atmospheric Environment (includes improved current and forecast information on adverse weather, winds, visibility, windshear, etc.)
  - Communications, Navigation, and Surveillance (includes utilization of satellite and data link technology)
  - Airport Improvements (includes airport lighting and markings, runway repairs)
  - Innovative/Cooperative Research (includes taking advantage of technology work being done elsewhere in government, industry, and academia)

- Most importantly they recommended the creation (if it didn't already exist) of a technical peer review group for each area under the auspices of the RE&D Advisory Committee's Technical Review Subcommittee. I personally will be taking on the Chairmanship of the Technical Review Subcommittee and will make the technical peer review groups a part of that subcommittee.

Joe DelBalzo responded to the Technical Review Subcommittee's recommendations by having his RE&D staff reorganize and rewrite the FY91 RE&D Plan to reflect the identified technology areas.

Human Factors, identified as an important area in the 1988 Aviation Safety Research Act, is being addressed by this committee under Dr. Garrison Rapmund who has been reviewing the FAA's automation work and its medical laboratory (CAMI) to make sure human factors (especially human performance) is being covered adequately in the R&D projects. The FAA has taken to heart the act's human factors imperative. They have hired a human factors expert, Dr. Clay Foushee, to lead the FAA's Human Factors Steering Committee. He has brought in many human factor's experts within and out of the government (and FAA) to review the FAA's work and set the tone/direction for utilizing human factors experts and principles on both near and far term projects.

The 1988 Aviation Act also identified the need for the FAA to have a National Simulation Laboratory (NSL) to do "systems rather than component research to help the FAA understand how new technologies, automation, or procedures will impact the capacity and safety of the NAS."

The Committee has asked Mr. Helms to chair the subcommittee looking into the needs and requirements for such a lab. The NSL subcommittee, made up of government, industry, and academic modeling and simulation experts will present its results at our next meeting.

The next meeting of the RE&D committee is scheduled for June. Committee meetings are open to the public and include discussions with the Administrator and his staff, reports by subcommittees and discussions of new activities. They also include visits to RE&D activities to give the group an opportunity to see work underway. We expect to continue to meet frequently, at least until we have had an opportunity to review the entire RE&D program and to make constructive overall recommendations.

Finally, Mr. Chairman, I would like to present to the Committee some personal views of the FAA's R&D program. First, it is apparent that there is not any consistent definition of R&D either within the Advisory Committee or the ATC community, of which the Advisory Committee is quite representative. We are a mix of research managers and ATC system users. The researchers are advocates for increased long-term research at the FAA, while the main focus of the system users is the expedition of new capabilities into operation. The focus on implementation of research results is obviously important for both long term and near-term R&D. And, as this subcommittee has noted, it is important to strike a balance between long-term and short-term activities.

Secondly, you are, I am sure, interested in what the Advisory Committee's recommendations are as to the appropriate size of the FAA R&D budget. The short answer is that we are not yet ready to answer that question. To do this properly, we would need to assess the requirements associated with alternative possible ATC system futures and develop an R&D program that provides an appropriate set of contingent technologies to meet these futures. One has only to think of the possibilities of satellite-based ATC to imagine how different the future system might be from today's system. In this regard, the FAA has two important activities underway. The first of these is a high-level future systems definition activity, reporting to the Associate Administrator for SE & Development. The second is Administrator Busey's initiative with the Deputy Administrator and the Executive Directors to develop an agency-wide strategic plan. It is only in this context that an RE&D plan has any relevance. The Advisory Committee will be monitoring these activities to develop its independent assessment of the scope and size of the FAA RE&D budget. Until that time, we will continue as we have to focus on improved program management.

Mr. Torricelli. Thank you, Mr. Everett.

Mr. Everett to what extent do you think the FAA has accepted the committee as a valuable resource, or are you being treated as some often are who are mandated by Congress and tolerated, but not appreciated.

Mr. Everett. I have served on a lot of committees, and I know what you mean. I believe that this committee is not only fully accepted, but is really appreciated by the Administrator and by Mr. Del Balzo and by the staff. They act like we really are there to help—and we really are there to help.

Mr. Torricelli. I hope that is the case, because that is our expectation, and that is important to us that you are being received that way.

Mr. Everett. I assure you we are.

Mr. Torricelli. Is it a fair criticism that the membership is heavily directed toward those who are concerned with their current problems, and therefore, problem solving, and perhaps not representative enough of those who might bring some visionary and long term dramatic changes to the system?

Mr. Everett. Well, as I said earlier, there are a lot of constituencies involved in air traffic control. An attempt is made to have those people represented on the committee, so —

Mr. Torricelli. Who is contributing the vision?

Mr. Everett. We are getting the vision for several reasons. One is that there are people on the committee who have thought about FAA and air traffic control for a long time, and they have the opportunity and the duty to bring their ideas forward.

Secondly, we are getting what we get from the recommendations of the FAA, and thirdly, through these subcommittees, we are able to add to the group people who have real knowledge and ideas about any of these things, so the idea is to make the committee itself sort of representative of the various parties involved, and to use it as a initiation and review committee, and to do most of the work through subcommittees which are staffed with experts and with people with long association with air traffic control, and who are encouraged, then, to bring up all the ideas that we can find.

Mr. Torricelli. Mr. Frisbie, is AERA-3, in your judgement, the future?

Mr. Frisbie. Yes, sir, I think it is.

Mr. Torricelli. And discuss for me, if you would, the impact on the human factors of AERA-3—the concerns it raises or why it does not.

Mr. Frisbie. Well, I think that the FAA is somewhat wary of AERA-3 for a couple reasons. One is that, I think, it disturbs controllers to think that one day a machine might take over their job, and I think, many years ago people in FAA — engineers were saying that could be done, and it had a certain influence on the workforce, so I think that there is some, perhaps, prudence in the approach that you heard from FAA today in not claiming too much for AERA-3.

I think, also, it is a very significant technical challenge and they faced a number of setbacks before they succeeded, and for that reason, they are not very bullish or perhaps they do not want to make extravagant claims for AERA-3. With regard to the specific human factors issue, I think Mr. Del Balzo addressed that when he talked about the concern for what the fall back modes would be. If we have a situation where the machine is delivering separation commands to aircraft and so forth, we have to be very concerned that the human monitor is in a position to override the machine if the machine fails in any way. I think that is a very significant human factors issue that we heard this morning, at least, that FAA was attentive to.

Mr. **Torricelli.** As someone who is relatively new to this entire aviation enterprise, it appears to me that before we enter into AERA-3, however, the movement continues to supplying technology that brings more and more information to the air controller. Having already basically arrived at the judgement that the air controller is already inundated with information, is this analysis which is based on my own brief experience wrong?

Mr. **Frisbie.** I think that what you see is, perhaps, the FAA moving in two directions at the same time.

Mr. **Torricelli.** That is my impression.

Mr. **Frisbie.** Yes, sir. And I think they are doing that because the ultimate payoff of a fully automated air traffic control—a machine doing the job is not something that they want to completely rely on, so absent that, they rely on the human in the loop to do those jobs, and they are trying to give that individual all of the information that the individual needs.

I think there is the possibility there that the human can be overloaded, and that is something that they need to look at as well. How to present this information, how to selectively present this information, so that the individual only has the information that he or she needs to react to the situation—

Mr. **Torricelli.** Not only can be overloaded, but probably is overloaded, and based on current planning for technological change in the near term, will be more so overloaded.

Mr. **Frisbie.** That is a possibility.

Mr. **Torricelli.** This isn't a theoretical problem that is arrived upon.

Sir?

Mr. **Everett.** If I may comment. I have been watching the growth of the air traffic control for some 40 years, and we have always been in this mode. In the early days, they were Four-course ranges and plate strips, and gradually the FAA has brought in computers and radars and all sorts of things. At each stage there has been a working system and controllers who knew how to run that system, and we are properly concerned about this next step, and that each time it has been necessary to earn the respect and confidence of the controllers and the rest of the people in the system, so that it would proceed, and I think that step is going forward, and there is no reason to think that we will not, in my opinion, that we will eventually reach Error-3 and perhaps go beyond. It is not an attempt to remove the controller. It is an attempt to improve the performance of the system without further overloading these poor fellows.

Mr. **Torricelli.** Two final questions.

Do each of you have confidence today in the—not only the availability, but the desirability of the FAA to shorten the time line between research, whether it is taking place in the aviation industry or in universities or other laboratories, and its practical testing and application? Is there both a willingness and a demonstrated ability to take full advantages of whatever breakthroughs are taking place, an open minded approach?

Mr. **Everett**. I think that is clearly a matter of the utmost importance.

Mr. **Torricelli**. We can agree on that. The question is whether it is taking place.

Mr. **Everett**. In my conversations with people in the FAA, they agree with that. Actually, shortening the time is not an easy matter. There are a lot of necessary steps. We are—

Mr. **Torricelli**. I am not asking whether it is easy, what I am asking is, as you see their operations, are you convinced that it is a priority with them and that it is taking place, in your judgement, to the greatest extent possible?

Mr. **Everett**. In my opinion, it is a priority with them, but the effects of that priority have yet to be seen.

Mr. **Frisbie**. I think, unfortunately, the answer to your question is no, and it is not because there is not an interest on behalf of people like Joe Del Balzo and the leaders of the—

Mr. **Torricelli**. What is the problem?

Mr. **Frisbie**. I think it is the Federal procurement regulations. The Federal procurement regulation make it very difficult for them to buy off the shelf technology, or go to a specific manufacturer who has a new gadget that could benefit aviation in the short term, and to say that we will choose that company X and bring that product directly into the industry.

Mr. **Torricelli**. Because of competition requirements or testing requirements. What—

Mr. **Frisbie**. Because, primarily, because of competition requirements—the need to give everybody who possibly could manufacture—

Mr. **Torricelli**. And in your judgement this has led to technology significant application of technology significant lagging development.

Mr. **Frisbie**. It has led to there being a very torturous course between FAA identifying technology that they think that they can use in the field and it actually being implemented in the field.

Mr. **Torricelli**. Would any of you finally like to comment on the question of the tiltrotor technologies and its impact on transportation and easing of congestion? Any thoughts?

[Silence.]

No thoughts.

You are the only people in Washington not to have a view on this.

[Laughter.]

Mr. **Torricelli**. How quiet is it.

You are the only people in the city who do not have an ax to grind on this, and the only people who don't have any kind of a contract on any side of the issue are the waiters in the Members dinning room, but who told me that when it landed yesterday, it made an unbelievable racket.

[Laughter.]

Mr. **Torricelli**. Thank you for joining us today. I appreciate your testimony very much and any thoughts you do have, Mr. Everett—you said you were not prepared to comment on the budget questions. We are, however, called upon to comment in very short order, and if you do have thoughts on it soon, please do correspond or call with myself or members of the staff. We would appreciate any further thought.

The committee stands adjourned.

[Whereupon, at 11:46 a.m., the subcommittee was adjourned, to reconvene at the call of the Chair.]

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